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A Semi-Quantitative Framework for Prioritizing Icelandic Bird Species for Monitoring and Management

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Cover photo: Greylag goose (Anser anser)*. Photo: Erling Ólafsson.*

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Hálfmegindlegur rammi til að forgangsraða íslenskum fuglategundum vegna vöktunar og stjórnunar

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Summary

This report presents a semi-quantitative framework for prioritizing 32 Icelandic bird species for monitoring and management investment. Sixteen of 34 contacted ornithological experts scored each species on six 0–3 criteria across three domains: conservation and risk (population trend, harvest sensitivity, Iceland's stewardship share), management leverage (whether effective regulatory tools exist), and monitoring value/feasibility (decision sensitivity and survey practicality). Three composite indices, Unweighted, Monitoring priority, and Management priority, were computed and compared, alongside a measure of expert disagreement. Management leverage was believed low for nearly every species except Rock Ptarmigan, while monitoring feasibility was uniformly high. Greylag Goose and Atlantic Puffin were the only species ranking near the top of all three indices, though both fall into a "closer look" rather than "no-regret" category because of unresolved expert disagreement: over monitoring feasibility for Puffin, and over population status and management leverage for Greylag Goose. Six species (Pink-footed Goose, Common Guillemot, Great Black-backed Gull, Fulmar, Raven, Lesser Black-backed Gull) qualify as no-regret priorities with strong expert agreement. A large cluster of seabirds ranks high for monitoring but low for management due to limited regulatory leverage. Long-tailed Duck shows the highest disagreement paired with a low score, flagging a genuine misclassification risk. The report recommends targeted follow-up elicitation and calibration exercises to distinguish real scientific uncertainty from ambiguous criteria wording.

Útdráttur

Í skýrslunni er kynntur hálfmegindlegur rammi (e. semi-quantitative framework) til að forgangsraða 32 íslenskum fuglategundum með tilliti til vöktunar og stjórnunar. Sextán af þeim 34 sérfræðingum í fuglafræði sem haft var samband við tóku þátt í matinu. Tegundirnar voru metnar eftir sex viðmiðum á kvarðanum 0–3, sem skiptust í þrjá flokka: verndarstöðu og áhættu (stofnþróun, næmi fyrir veiðiálagi og hlutdeild Íslands í viðkomandi stofni), stjórnunarmöguleika (hvort tiltæk séu stjórntæki sem geti skilað árangri) og gildi og framkvæmanleika vöktunar (hversu næmar ákvarðanir eru fyrir óvissu og hversu raunhæft sé að afla vöktunargagna). Reiknaðar voru þrjár samsettar vísitölur: óvigtuð vísitala, vöktunarforgangsvísitala og stjórnunarforgangsvísitala. Vísitölurnar voru bornar saman og staðalfrávik notað til að mæla skoðanamun sérfræðinga.

Talið var að stjórnunarmöguleikar væru takmarkaðir fyrir nánast allar tegundir nema rjúpu, en almennt var talið vel framkvæmanlegt að afla vöktunargagna. Grágæs og lundi voru einu tegundirnar sem röðuðust nálægt toppi allra þriggja vísitalna. Báðar féllu þó í flokk tegunda sem krefjast nánari skoðunar frekar en öruggar forgangstegundir (e. no-regret category) vegna ósamræmis í mati sérfræðinga. Hjá lunda snérist það um framkvæmanleika vöktunar og hjá grágæs um stofnstöðu og stjórnunarmöguleikum. Sex tegundir, heiðagæs, langvía, svartbakur, fýll, hrafn og sílamáfur, teljast öruggar forgangstegundir með mikilli samstöðu sérfræðinga. Stór hópur sjófugla raðast ofarlega í forgangsröðun vegna vöktunargildis en neðarlega vegna stjórnunar, vegna takmarkaðra stjórntækja. Mest ósamræmi var í mati á hávellu, sem jafnframt fékk lágt skor. Það bendir til raunverulegrar hættu á rangri flokkun.

Í skýrslunni er mælt með því að sannreyna hvort þátttakendur hafi lagt sama skilning í matsviðmiðin til að greina hvort raunveruleg vísindaleg óvissa eða óljóst orðalag viðmiðanna liggi að baki skoðanamunar þeirra.

Lykilorð
Birds, Iceland, species prioritization, monitoring, management
Fuglar, Ísland, forgangsröðun tegunda, vöktun, stjórnun

Yfirfarið

EFNISYFIRLIT

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1 PURPOSE

This document describes a semi-quantitative framework used to prioritize bird species in Iceland for both monitoring investment and management attention. The framework is similar to that of Regan et al. (2008. Species prioritization for monitoring and management in regional multiple species conservation plans. Diversity and Distributions 14:462–471) and is designed to be transparent, repeatable, and suitable for application in data-limited contexts.

We developed a scoring sheet for 32 species of Icelandic birds, of which only six are protected from exploitation (although egg collecting is permitted, it is not widely practiced). The scoring sheet is described below. We contacted 34 professionals in Iceland with ornithological expertise, including those in government research and management, along with two non-governmental organizations. After several follow-up attempts, we received a total of 16 responses, although not all respondents scored all species on all criteria.

2 OVERVIEW OF THE PRIORITIZATION APPROACH

Each species is evaluated against six criteria grouped into three conceptual levels: (A) conservation and risk, (B) management leverage, and (C) monitoring value and feasibility. All criteria are scored on a 0–3 ordinal scale. Scores are intended to represent relative magnitude, not precise quantitative estimates.

2.1 Criteria A. Conservation and risk

Criteria A comprise the degree to which a species warrants management attention based on conservation status, demographic sensitivity, and Icelandic stewardship responsibility.

A1. Population status and trend
This criterion reflects documented population trends and conservation concern at national or international scales. Scores are interpreted as follows:

0 = stable or increasing population with no indication of concern;
1 = uncertain trend or weak decline;
2 = clear decline or low population size of concern;
3 = strong decline or formal conservation concern (e.g., national red listing).

A2. Sensitivity to harvest
This criterion evaluates the likelihood that harvest mortality is additive and capable of influencing population growth. Life-history characteristics such as longevity, age at first breeding, and fecundity inform scoring:

0 = harvest mortality likely compensatory or negligible;
1 = harvest potentially additive but small relative to total mortality;
2 = harvest likely additive for some age classes;
3 = harvest plausibly limiting population growth.

A3. Icelandic responsibility
This criterion reflects the proportion of the relevant population for which Iceland bears stewardship responsibility, considering breeding, staging, or wintering importance:

0 = marginal contribution;
1 = moderate share;
2 = large share;
3 = dominant share of the global or flyway population.

2.2 Criteria B. Management leverage

Criteria B describes whether management intervention can plausibly change outcomes. High conservation need does not automatically imply high priority if management leverage is weak.

B1. Scope for management to change outcomes
This criterion reflects the existence and effectiveness of regulatory or management levers related to harvest:

0 = little or no regulatory control or enforcement;
1 = management possible but weak leverage;
2 = clear regulatory mechanisms exist;
3 = strong and enforceable management levers plausibly influence population trajectory.

2.3 Criteria C. Monitoring value and feasibility

Criteria C examine monitoring as an investment. Monitoring is prioritized where uncertainty reduction is expected to improve management decisions and where informative data can realistically be obtained.

C1. Decision sensitivity (Value of Information)
This criterion assesses whether improved information would plausibly change management decisions:

0 = decisions insensitive to uncertainty;
1 = minor adjustments only;
2 = alternative management actions plausible depending on information;
3 = management decisions hinge strongly on uncertain parameters.

C2. Monitoring feasibility
This criterion reflects logistical feasibility, detectability, and cost:

0 = impractical or prohibitively expensive;
1 = difficult but feasible;
2 = feasible with moderate effort;
3 = feasible with existing surveys or modest additions.

2.4 Indices and prioritization outputs

We computed three composite indices to characterize species priority from different management perspectives. The Unweighted index sums all six expert-scored criteria equally (A1–C2) and serves as a general baseline that makes no assumptions about purpose. The Monitoring priority index draws on the criteria most relevant to surveillance and information needs: population status and trend (A1), Icelandic responsibility (A3), decision sensitivity (C1), and monitoring feasibility (C2). It excludes harvest sensitivity (A2) and management leverage (B1), which reflect actionability rather than knowledge gaps. The Management priority index is structured differently: it multiplies a need score (A1 + A2 + A3) by management leverage (B1), so that species with high conservation need but no available management tool score zero, reflecting the pragmatic constraint that priority for active intervention should be conditional on having an effective lever to pull. Convergence across all three indices identifies species that are unambiguous high priorities regardless of purpose, while divergence flags species whose priority is specific to one context: monitoring versus management. For the Unweighted index, expert disagreement, measured as the mean standard deviation across criteria scores, is examined alongside the index score itself to identify four practical categories: (1) species that score high with strong expert agreement are no-regret priorities; (2) those that score low with strong agreement can be confidently deprioritized; (3) those that score high but with high disagreement warrant a closer look before committing resources; and (4) those that score low but with high disagreement carry a risk of misclassification, where unresolved uncertainty may be masking a genuine priority.

3 RESULTS

Two of the six criteria stood out for being unusually uniform across species, but in opposite directions (Fig. 1). Management leverage (B1) was low for nearly every species, with median scores of 0 or 1 throughout the list; only Rock Ptarmigan stood out, with a strong consensus that effective regulatory tools exist for that species. By contrast, monitoring feasibility (C2) was consistently high, indicating that most species are considered trackable with existing or expanded survey effort regardless of their conservation status. Population status and Icelandic responsibility varied much more widely across species, as expected given that these reflect underlying ecological differences rather than a shared logistical or regulatory constraint.

These criterion-level patterns carried through to the three composite indices, ordered by Unweighted (Fig. 2), Monitoring (Fig. 3), and Management (Fig. 4). Greylag Goose and Atlantic Puffin were the only species to rank near the top of the Unweighted, Monitoring, and Management indices simultaneously, making them the clearest candidates for priority status regardless of programmatic purpose. Below these two species, a substantial cluster of seabirds, including Common Guillemot, Great Black-backed Gull, Thick-billed Murre, Fulmar, Glaucous Gull, Razorbill, Parasitic Jaeger, and Black-legged Kittiwake, scored highly on both the Unweighted and Monitoring indices but fell sharply on the Management index, reflecting the broader pattern of limited management leverage described above. These species remain strong candidates for continued or enhanced monitoring even though current management tools offer little direct traction.

Disagreement among experts' scores is summarized using the Unweighted index, which incorporates both the monitoring- and management-relevant criteria and is therefore intended to flag species warranting closer attention under either purpose. Plotting each species' Unweighted priority against the mean standard deviation of its criterion scores separates the 32 species into four practical categories (Fig. 5). A small set of high-priority, high-agreement species, including Pink-footed Goose, Common Guillemot, Great Black-backed Gull, Fulmar, Raven, and Lesser Black-backed Gull, can be treated as no-regret priorities. While these species scored relatively high on the Monitoring index, experts believed that only Common Guillemot, Fulmar, and Pink-footed Goose had sufficient management leverage. A larger group, including Greylag Goose, Atlantic Puffin, Thick-billed Murre, Glaucous Gull, and several other seabirds, scored relatively high but with above-median disagreement and therefore warrant a closer look before resources are committed. A third group of species, including Long-tailed Duck, Red-breasted Merganser, European Shag, and Great Cormorant, scored relatively low but with high disagreement, placing them at risk of misclassification, since their apparent low priority may not be reliable. The remaining species scored low with strong agreement and can be confidently deprioritized.

To better understand the sources of disagreement, criterion-level boxplots were constructed for three species in the closer-look category: Atlantic Puffin, Greylag Goose, and Rock Ptarmigan. For Atlantic Puffin, most disagreement concerned monitoring feasibility, with experts split between those believing adequate monitoring is feasible with modest enhancements and those believing monitoring to be feasible but difficult (Fig. 6). There was not wide disagreement on population status and responsibility, nor on low management leverage.

For Greylag Goose, experts agreed that harvest sensitivity is high, but disagreed substantially on population status and, importantly, on management leverage (Fig. 7). Monitoring feasibility was also widely disputed, with scores ranging from 1 to 3.

The results were somewhat surprising for Rock Ptarmigan, with relatively high disagreement concerning population status and harvest sensitivity (Fig. 8). However, there was very little disagreement concerning management leverage and monitoring feasibility, likely reflecting the rigorous monitoring and harvest-management plan in place for this species.

Long-tailed Duck had the highest level of disagreement among experts and had low overall scores, suggesting the risk of misclassification (Fig. 9). The greatest disagreement among experts was for population status and monitoring feasibility, with many scores falling at the extremes of 0 and 3. Decision sensitivity also spanned the full range, while harvest sensitivity, Icelandic responsibility, and management leverage showed less extreme but still notable disagreement, mostly falling between 0 and 2. However, these lower scores may not be reliable given the disagreement about population status and monitoring feasibility.

Taken together, these results show that the source of expert disagreement varies by species rather than following a single pattern. For some high-priority species, such as Atlantic Puffin, conservation status is well agreed upon and uncertainty is concentrated in how monitoring should proceed. For others, such as Rock Ptarmigan, the reverse is true: the practical mechanics of management and monitoring are well established, but the underlying conservation status itself remains contested. Greylag Goose and Long-tailed Duck show disagreement spanning both categories. This suggests that a single follow-up consultation on monitoring design would resolve uncertainty for some species but not others; a more efficient approach would be to target each species' follow-up toward whichever criteria actually drove its classification as high-disagreement, rather than assuming a common cause.

4 CONCLUSIONS

This elicitation effort identified Greylag Goose and Atlantic Puffin as the only unambiguous priorities in the dataset, scoring near the top of the Unweighted, Monitoring, and Management indices simultaneously. Neither species can yet be treated as fully resolved, however, since both fall into the closer look rather than the no-regret category in the disagreement analysis (Fig. 5). The source of that disagreement differs between the two species. For Atlantic Puffin, conservation status is essentially undisputed, and the remaining uncertainty concerns monitoring feasibility. For Greylag Goose, disagreement is broader, extending to population status and to management leverage itself, the criterion that determines whether active intervention is warranted.

Rock Ptarmigan illustrates that disagreement does not follow a single pattern across species. Where Atlantic Puffin, and to a lesser extent Greylag Goose, show greater consensus on conservation status than on the practical questions of management and monitoring, Rock Ptarmigan shows the reverse. Experts agreed closely that management leverage and monitoring feasibility are both strong for this species, likely reflecting its existing harvest management program, but disagreed substantially on its underlying population status and harvest sensitivity. This indicates that the appropriate follow-up differs by species. For some, additional consultation on monitoring design would resolve the outstanding uncertainty. For others, a closer examination of population data itself would be more productive.

A broader structural pattern emerged across nearly all 32 species. Management leverage was low for almost every species evaluated, with only Rock Ptarmigan showing strong evidence of an effective

regulatory lever (Fig. 1). A substantial cluster of seabird species, including Common Guillemot, Great Black-backed Gull, Thick-billed Murre, Fulmar, Glaucous Gull, Razorbill, Parasitic Jaeger, and Black-legged Kittiwake, carry meaningful conservation weight and rank highly for monitoring purposes but offer little traction for active management given currently available tools (Fig. 2). This is not a limitation of the scoring framework but a genuine constraint that the results make explicit, and it supports treating monitoring and management investment as separate decisions rather than assuming that one follows automatically from the other.

Long-tailed Duck represents the clearest case of unresolved priority in the elicitation, combining the highest level of expert disagreement of any species with a low overall priority score (Figs. 5 and 9). Because this combination is a pattern the framework is designed to flag as a misclassification risk, its current low-priority status should not be treated as settled without additional expert input.

Cross-referencing priority classification with current legal protection offers a partial check on the framework. Five of the six species fully protected from hunting (Arctic Tern, Barrow's Goldeneye, Greater White-fronted Goose, Northern Gannet, and Great Skua) fall into the low-concern category, consistent with their protected status. The exception is Black Guillemot, which falls into the misclassification-risk group: despite its protected status, expert disagreement was high enough that its apparently low priority should not be treated as settled.

4.1 Elicitation Considerations

- Only 16 of 34 contacted experts responded, with per-criterion sample sizes ranging from 9 to 16. A follow-up round targeted at non-respondents, or splitting the survey into shorter modules, would improve precision, particularly for less commonly encountered species where small samples are most likely to distort the priority and disagreement scores.

- Management leverage (B1) and monitoring feasibility (C2) were both unusually uniform across nearly all species, which could reflect a real pattern or could mean these scales aren't capturing meaningful variation. Adding concrete calibration examples or anchoring language to each scale point would help confirm whether the uniformity is signal or an artifact of ambiguous wording.

- Consider testing whether disagreement reflects differing interpretations of the criteria rather than differing expert knowledge. This limitation has been noted above. A short calibration exercise, in which a subset of experts score two or three reference species together and compare their reasoning, would help determine how much of the observed disagreement stems from ambiguity in the criteria versus genuine scientific uncertainty. This distinction matters for deciding whether future effort should focus on clarifying criteria definitions or on collecting additional elicitation data.

4.2 Administrative Considerations

- No-regret species: Pink-footed Goose, Common Guillemot, Great Black-backed Gull, Fulmar, Raven, and Lesser Black-backed Gull have both meaningful priority scores and strong expert agreement. Additional consultation isn't needed before acting on these.

- Follow-up should perhaps be considered for Greylag Goose and Atlantic Puffin, the only two species ranking near the top of all three composite indices. The sources of uncertainty differ between them. For Atlantic Puffin, disagreement is concentrated on monitoring feasibility, with experts split between those who see adequate monitoring as achievable with modest enhancements and those who consider it feasible but difficult. Population status (poor) and management leverage (low) are not in dispute. For Greylag Goose, disagreement is broader, spanning population status, management leverage, and monitoring feasibility, so resolving its monitoring and management priorities will require a closer look.

- Administrators ultimately have to decide whether to invest in monitoring species or pursue new management authority for them (or some combination thereof). A large cluster of seabirds (Common Guillemot, Great Black-backed Gull, Thick-billed Murre, Fulmar, Glaucous Gull, Razorbill, Parasitic Jaeger, Black-legged Kittiwake) rank high for conservation/monitoring value but have little current management leverage. That's a genuine resource-allocation choice for administrators, not something the framework can resolve.

- The priority for Long-tailed Duck is the most unsettled of all species. It combines the lowest confidence (highest disagreement) with a low score, and so it represents a misclassification risk. Its current low-priority status warrants additional expert input before being used to justify de-prioritization.

5 ACKNOWLEDGEMENTS

I thank the 16 individuals who responded to my request for help in prioritizing avian species for monitoring and management in Iceland. I refrain from mentioning them by name to protect their anonymity. Funding for this work was provided by the Icelandic Institute of Natural History. Logistical support was provided by the Nature Conservation Agency of Iceland. Any opinions expressed herein are solely those of the author and do not necessarily represent the positions of Iceland’s governmental agencies.

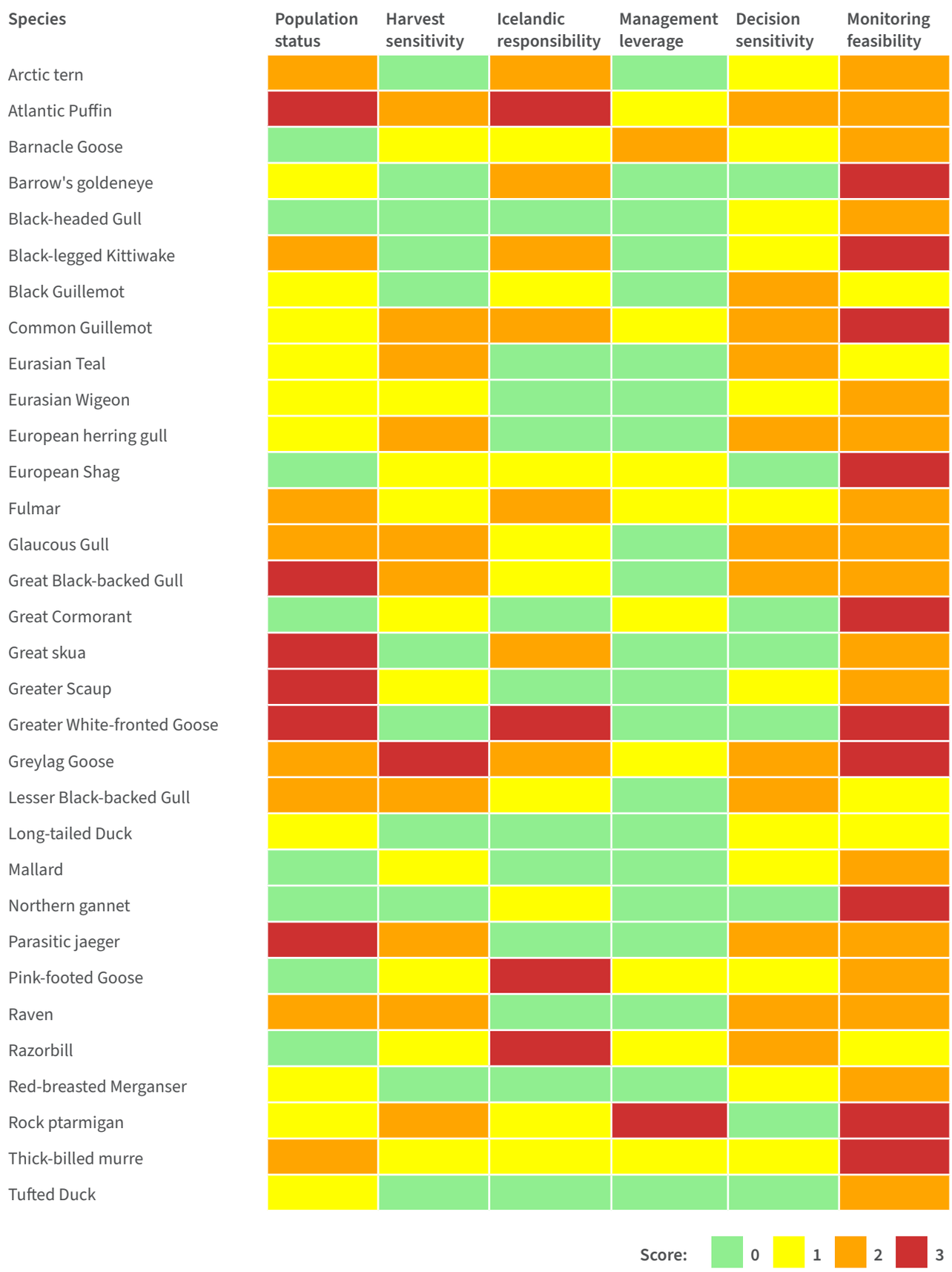


Fig. 1. Median scores for 32 Icelandic birds on 6 criteria, which were elicited from 16 ornithological experts.



Fig. 2. Mean scores for prioritizing monitoring and management of 32 bird species in Iceland ordered by Unweighted indices.



Fig. 3. Mean scores for prioritizing monitoring and management of 32 bird species in Iceland ordered by Monitoring indices.



Fig. 4. Mean scores for prioritizing monitoring and management of 32 bird species in Iceland ordered by Management indices.

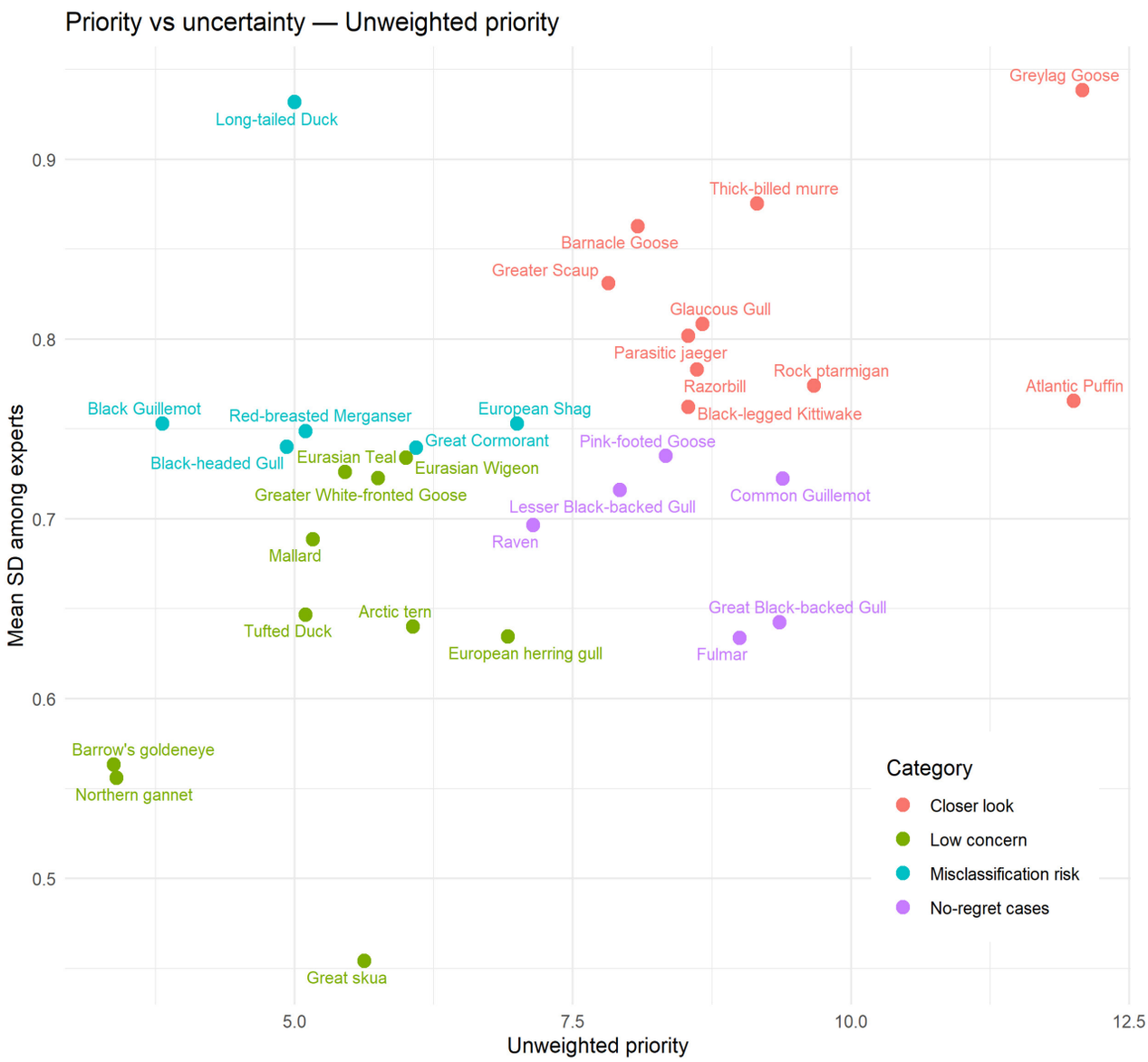


Fig. 5. The relationship between unweighted mean scores and their standard deviations for 32 Icelandic birds scored by 16 ornithological experts.

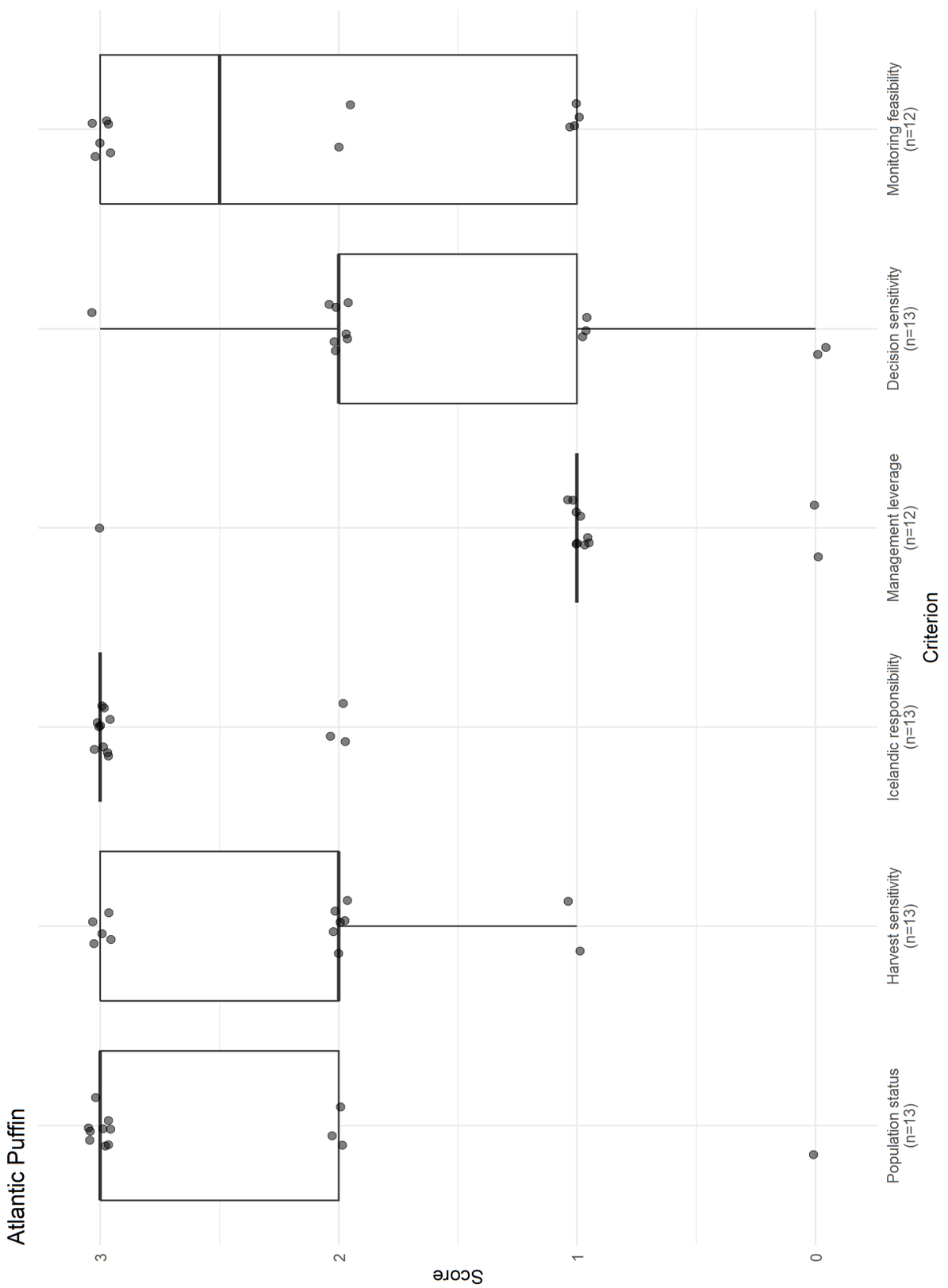


Fig. 6. Experts' scoring of Atlantic Puffin across six criteria. Boxes represent the interquartile range. Sample size is shown below each criterion.

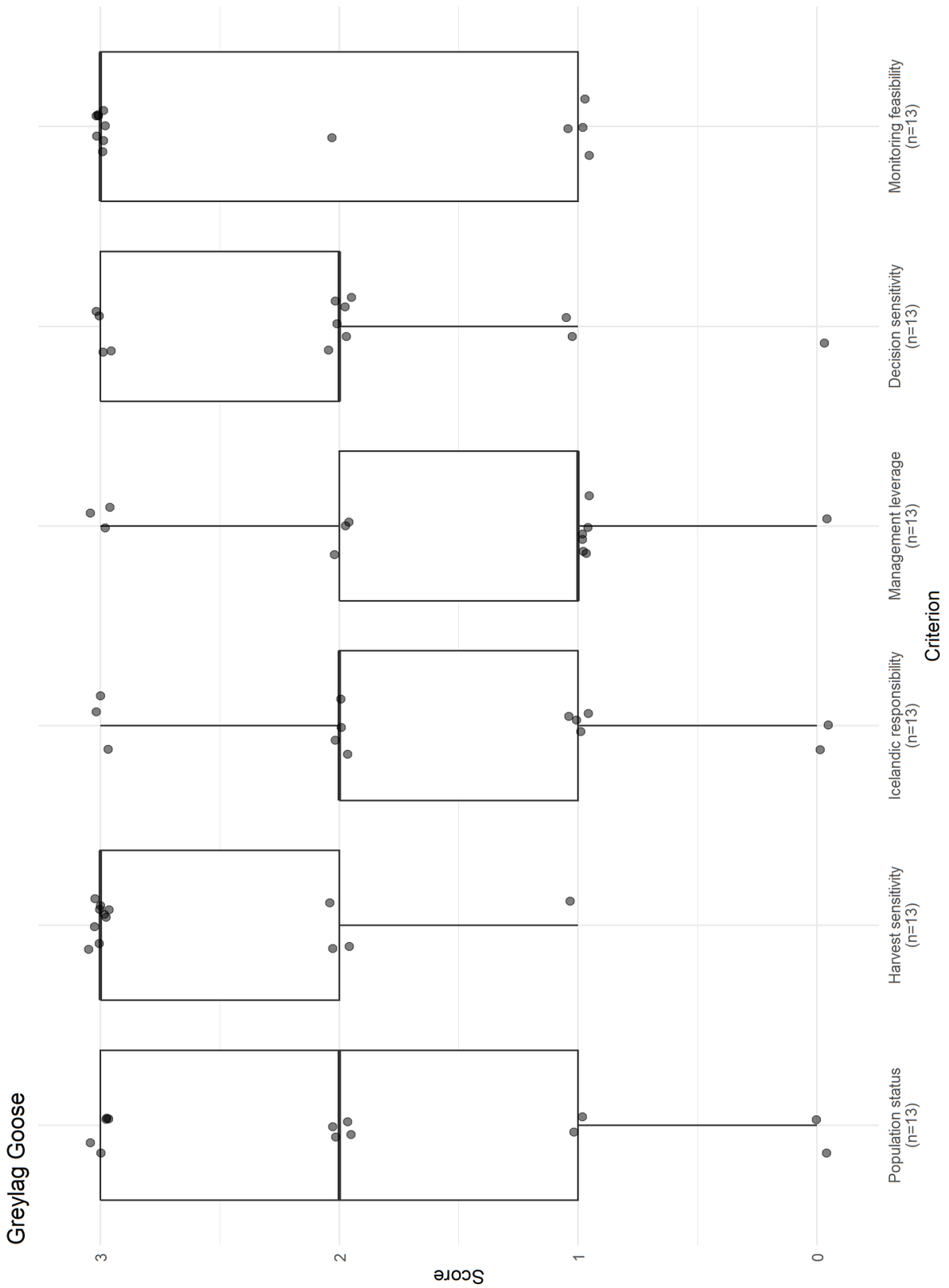


Fig. 7. Experts' scoring of Greylag goose across six criteria. Boxes represent the interquartile range. Sample size is shown below each criterion.

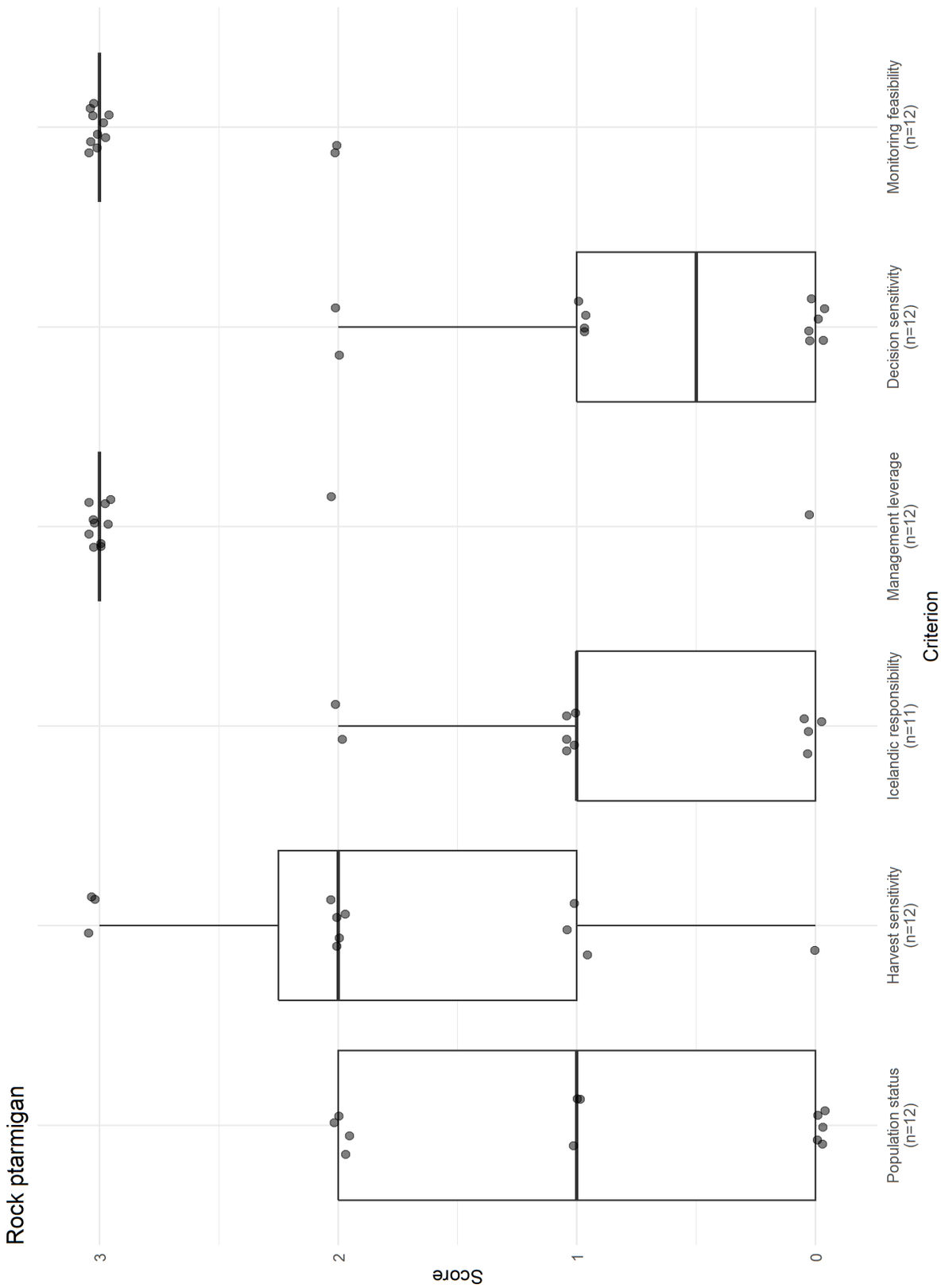


Fig. 8. Experts' scoring of Rock Ptarmigan across six criteria. The boxes represent the interquartile range. Sample size is shown below each criterion.

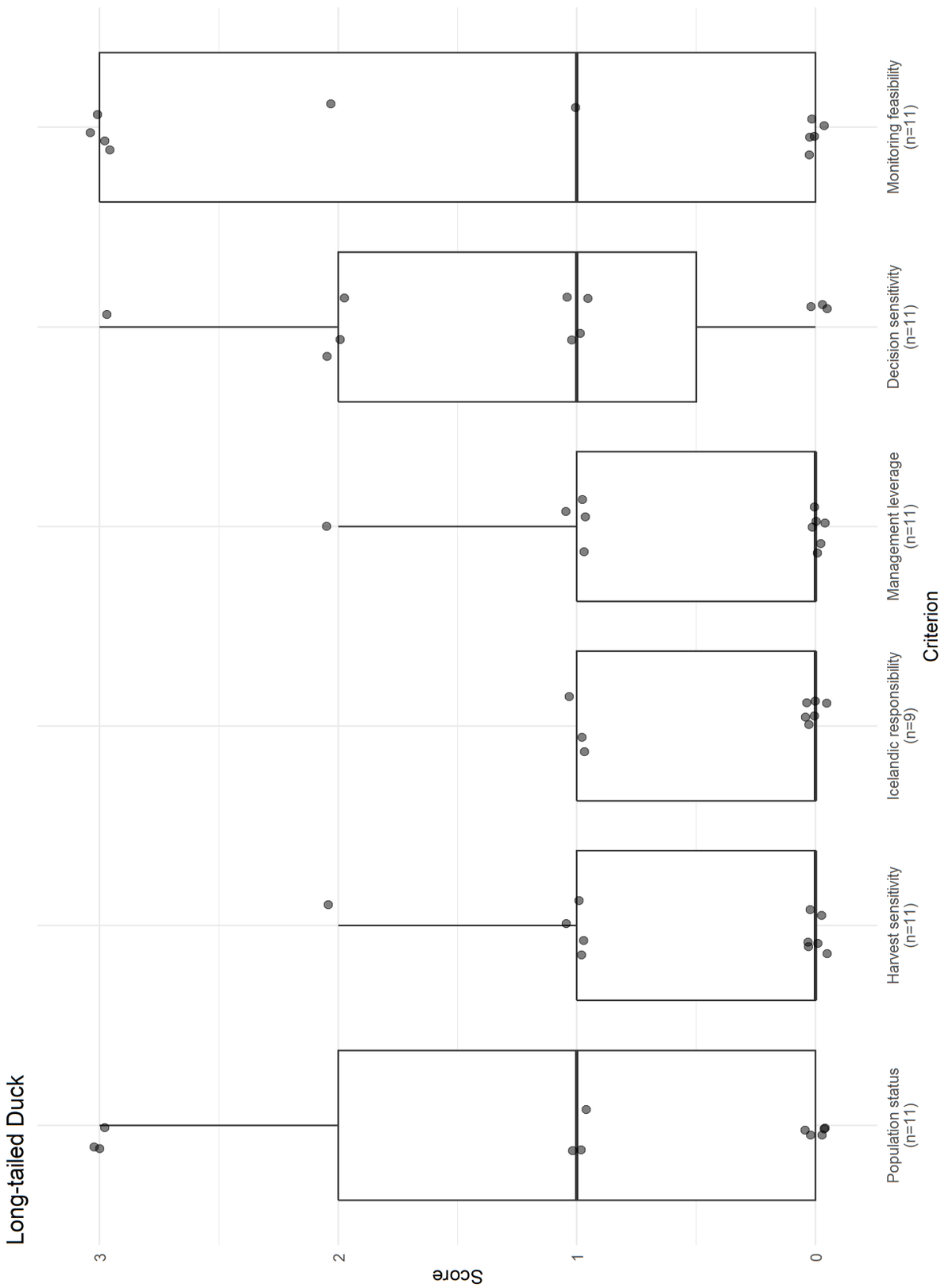


Fig. 9. Experts' scoring of Long-tailed duck across six criteria. The boxes represent the interquartile range. Sample size is shown below each criterion.