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Te Whatu Ao

Waiau River elver stocking and monitoring strategy

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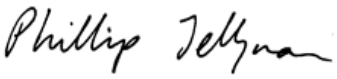
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1 Introduction

The Elver Stocking and Monitoring Strategy provides a framework for improving the effectiveness of elver transfers within the Waiau catchment and evaluating whether they are fulfilling the requirements of Meridian's consent to support the long-term sustainable management of longfin eel populations. The strategy focusses on measurable ecological outcomes, including recruitment, survival, dispersal, silver eel production, and ultimately their contribution to the longfin eel population. We recognise that eels support other values and outcomes (e.g., customary and recreational values), but we have focused on ecological outcomes for the purposes of this report.

The strategy is guided by a strategic goals framework that links stocking activities to desired ecological outcomes and provides a basis for adaptive management. The framework is intended to support decision-making, reduce key uncertainties, and enable management actions to be refined as new information becomes available.

The Elver Stocking and Monitoring Strategy sits within the broader Migrant Eel Mitigation Programme (MEMPRG), whose objective is:

> *"To identify options and potential solutions for the existing impact of the Manapōuri Power Scheme (MPS) on migrating eels, in order that the effects of the MPS are consistent with sustainable management of the longfin eel population."*

For the purposes of this strategy, we defined the ecological aspects of sustainable management to be maintaining the abundance, biomass, age structure, distribution, and reproductive potential of longfin eel populations throughout the Waiau catchment.

Elver stocking addresses one component of the impacts associated with the MPS by restoring recruitment to habitats upstream of the Manapōuri Lake Control Structure (MLC). Although stocking cannot fully offset all impacts of the MPS, particularly those affecting downstream-migrating silver eels, it has the potential to increase eel abundance in upstream habitats and contribute to future silver eel production. The strategic goals framework described below provides the basis for assessing whether these ecological outcomes are being achieved.

2 Strategic goals framework

The Elver Stocking and Monitoring Strategy is intended to support the long-term sustainability of longfin eel populations within the Waiau catchment. To achieve this, the strategy uses a hierarchical goals framework comprising a single fundamental goal (i.e., the overarching objective) supported by a series of means goals (i.e., intermediate objectives required to achieve the fundamental goal). Together, these goals define the desired outcomes of the programme and provide the basis for the strategy design, monitoring, evaluation, and adaptive management.

2.1 Fundamental goal

Maintain the abundance, biomass, age structure, distribution, and reproductive output of longfin eel populations within the Waiau catchment.

This goal represents the desired long-term outcome of the stocking programme and is aligned with the broader objectives of the MEMPRG.

2.2 Means goals

Achievement of the fundamental goal depends on a series of intermediate outcomes, referred to as 'means goals', that can be influenced directly through management actions. Specifically, the Elver Stocking and Monitoring Strategy aims to:

- restore recruitment of longfin eels to suitable habitats upstream of the MLC;
- maximise the survival of elvers during capture, transport, and release;
- promote dispersal of transferred elvers throughout suitable habitats;
- align stocking locations and stocking densities with habitat availability and carrying capacity;
- maximise the contribution of stocked habitats to future silver eel production and escapement; and
- reduce key uncertainties through targeted monitoring, evaluation, and adaptive management.

These means goals describe the expected pathway by which elver transfers contribute to the long-term ecological sustainability of longfin eel populations in the Waiau catchment. Progress towards each goal should be evaluated through a structured adaptive management process so that management actions can be refined as new information becomes available.

3 Adaptive management framework

The Elver Stocking and Monitoring Strategy adopts an adaptive management framework that links stocking activities to a series of measurable ecological outcomes. This framework provides a structured process for evaluating programme performance, identifying constraints on success, and refining management actions over time.

The effectiveness of the stocking programme should be evaluated through the adaptive management pathway illustrated in Figure 3.1. The pathway represents the sequence of biological processes required for transferred elvers to contribute to the long–term sustainability of longfin eel populations within the Waiau catchment.

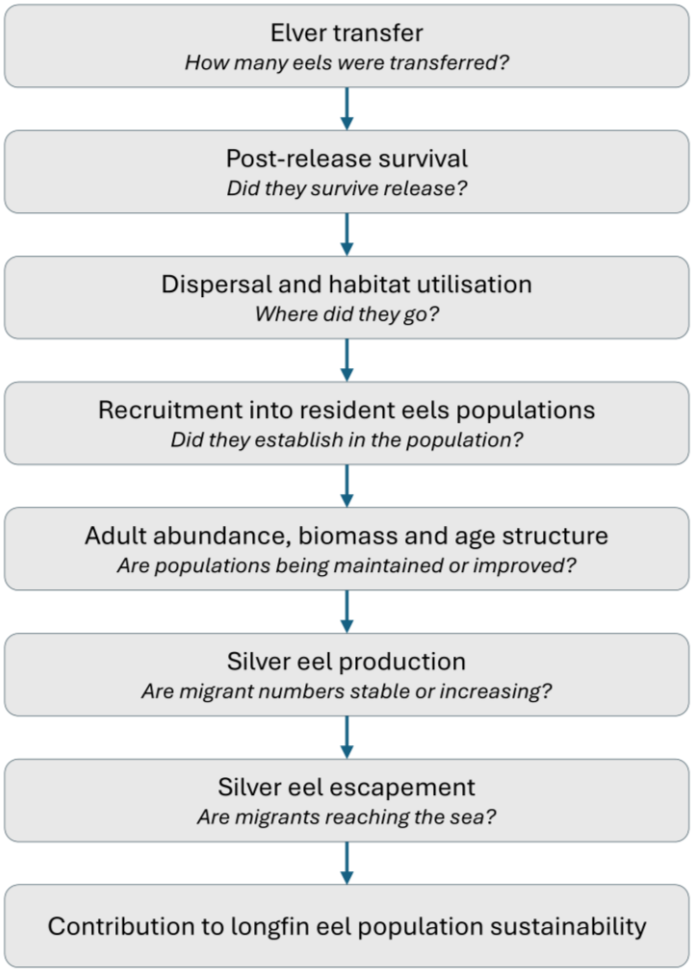


Figure 3.1 Conceptual adaptive management pathway for evaluating the Elver Stocking and Monitoring Strategy.

Monitoring should be designed to assess each stage of the pathway and determine whether transferred elvers are progressing successfully from release through to recruitment, population contribution, and ultimately silver eel production and escapement. Information gathered at each stage should be used to guide decisions regarding stocking locations, stocking densities, transfer methods, and future monitoring priorities.

Each stage in the pathway represents a necessary condition for success. Constraints or failures at any stage will reduce the likelihood that stocked elvers will contribute to future silver eel production and the broader objectives of the programme. Monitoring should, therefore, focus on reducing key uncertainties and identifying bottlenecks and opportunities for improvement so that management actions can be adapted accordingly.

Table 3.1 summarises the primary monitoring approaches associated with each stage of the adaptive management pathway.

Table 3.1 Adaptive management pathway and associated monitoring priorities.

Stage	Key question	Potential monitoring approaches
Transfer	How many elvers are transferred and where are they released?	Transfer records and release–site records.
Survival	Do elvers survive capture, transport, and release?	PIT tagging for short–term survival studies to assess transport and release, and long–term survival studies to assess carrying capacity.
Dispersal	How do elvers disperse from release sites and what habitats do they utilise?	PIT tagging, mark–recapture studies, biotelemetry.
Recruitment	Do elvers successfully establish in recipient habitats?	Population surveys and recruitment assessment.
Population response	Are resident eel abundance and biomass increasing over time?	Long–term population monitoring.
Silver eel production	Are stocked habitats contributing to the production of mature migrant eels?	Population monitoring, maturation assessments, modelling, tagging studies.
Escapement*	Are enough migrant eels leaving the catchment?	Escapement monitoring, passage studies, biotelemetry.

* Stocking will influence the number of silver eels trying to migrate to the ocean and where in the catchment they are attempting to escape from. However, escapement is also influenced by factors beyond the stocking programme and must be considered within the wider Migrant Eel Mitigation Programme. Information collected through the Elver Stocking and Monitoring Strategy should contribute to, and be interpreted alongside, broader programme–scale assessments of downstream migration and passage success.

The adaptive management pathway provides the link between the strategic ecological goals of the programme and the monitoring programme. By evaluating each stage in the pathway and responding to the results, the Elver Stocking and Monitoring Strategy can progressively improve its effectiveness and optimise its contribution to the long–term sustainability of longfin eel populations within the Waiau catchment.

4 Operational improvements (Years 1–3)

Several improvements can be implemented over the next three years to improve the spatial distribution of stocked elvers, increase utilisation of available habitat, and maximise the contribution of stocked eels to future silver eel production. The proposed approach follows a staged process.

1. Re-establish use of release sites approved before the detection of didymo.
2. Review elver collection and transport standard operating procedures (SOPs)
3. Assess opportunities to expand the release network.
4. Prioritise potential release sites based on biological and operational criteria in collaboration with the trap and transfer operators and the Eel Working Group[1].
5. Review catchment-level proportional distribution of elver transfers
6. Implement an expanded and adaptive stocking strategy.

4.1 Re-establish stocking across existing release sites (Year 1)

The initial priority should be to restore stocking to the original six release sites identified by Jellyman et al. (2012; Figure 4.1) across the Te Anau, Manapōuri and Mararoa catchments and utilised prior to the discovery of Didymo, which reduced the number of stocking sites being used. Returning to the full suite of original release sites would be subject to site accessibility and any required approvals.

Access to some of the original sites may be improved using the transfer team's new tanker, which is fitted with a 10 m hose that may be extendable. Operational trials should be undertaken in the 2026/27 trap-and-transfer season to confirm that each site can be accessed safely and efficiently while maintaining appropriate fish welfare standards.

Re-establishing stocking across the full range of existing release sites would reduce localised stocking densities, increase utilisation of available habitat, and promote greater dispersal throughout the catchment. This approach is consistent with the recommendations of Jellyman et al. (2010, 2012) for the Waiau catchment and the wider literature (e.g., Cowx 1999; ICES 2016; Aprahamian et al. 2021; Pedersen et al. 2024), which supports the use of multiple release sites to maximise recruitment opportunities and minimise the risk of habitat saturation.

[1] Parties to be consulted by Meridian on the development and implementation of its eel-related activities under Condition 5 of its water permit 96022, hereafter referred to as the 'Eel Working Group'.

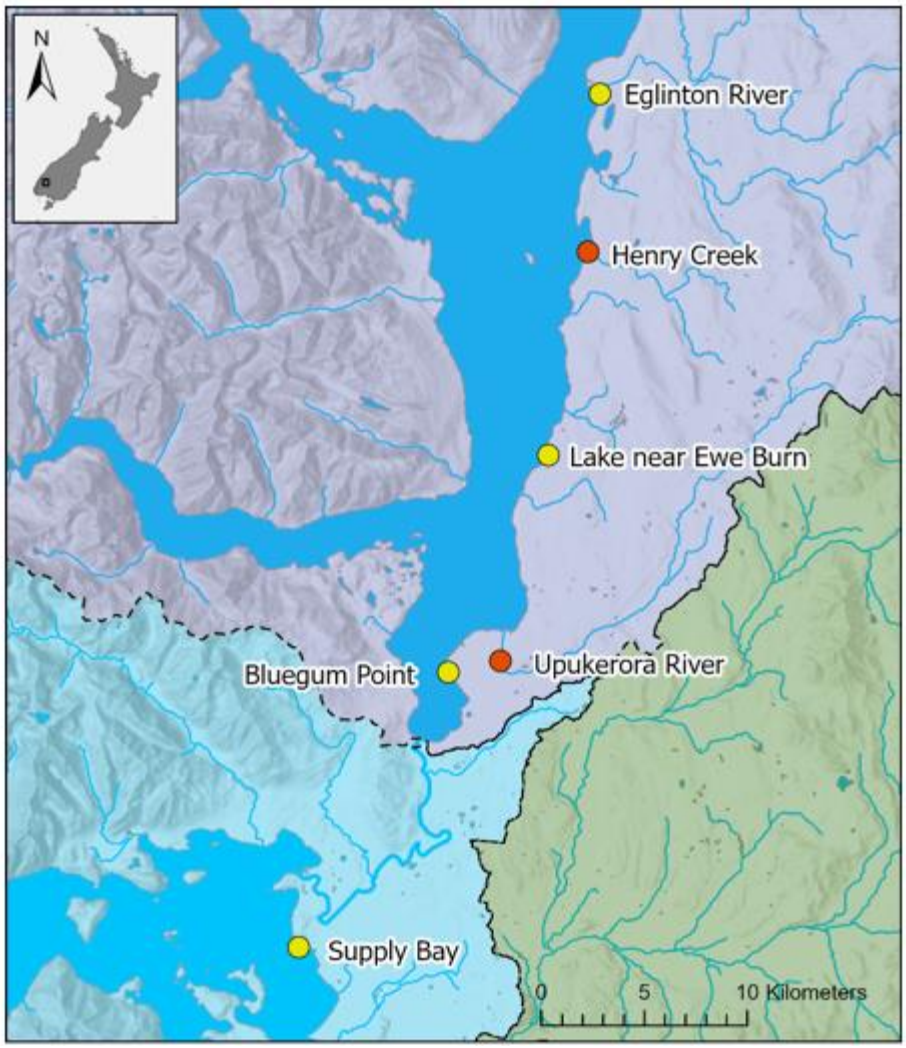


Figure 4.1 Original elver release sites suggested by Jellyman et al. (2012). The 'primary' sites for elver transfer are marked in yellow. The secondary sites that should receive "smaller quantities of elvers" are marked in red.

4.2 Review elver collection and transport SOPs (Year 1)

During Year 1, the Standard Operating Procedures (SOPs) for elver collection, handling, and transport should be reviewed and updated, where required, to support the expanded network of release sites. The review should assess existing collection and transfer protocols considering proposed operational changes, including longer transport distances to new road-accessible release locations and the use of upgraded equipment, such as the transfer team's new transport tanker.

The review should be carried out alongside the elver transfer team and focus on identifying opportunities to optimise fish handling procedures, maintain high water quality throughout transit, and minimise handling-related stress. Any revisions should align SOPs with current best-practice standards and ensure processes remain fit for purpose as the programme expands. Maintaining robust fish welfare standards during collection and transfer will help maximise short-term survival and support successful establishment of elvers across recipient habitats.

4.3 Assess opportunities to expand the release network (Year 1)

Once the feasibility of using the original release sites has been assessed, Meridian should work with the transfer team to identify additional release sites that could further improve stocking distribution across the catchment.

The initial focus should be on road–accessible sites that can be incorporated into the existing trap–and–transfer programme with minimal additional operational complexity. The assessment should consider:

- site accessibility and operational constraints;
- Department of Conservation approval requirements and any other permissions required for stocking;
- vehicle access, transfer distances and safe release methods;
- seasonal access limitations;
- additional costs associated with servicing new sites; and
- potential effects of longer transport times or additional handling on elver condition, fitness and survival.

A preliminary desktop assessment has identified several potential new release sites (Table 4.1; Figure 4.2). These sites should be validated through field inspections and operational trials during the 2026/27 trap–and–transfer season to confirm access requirements and determine whether they can be serviced safely and efficiently while maintaining fish welfare standards.

Table 4.1 Proposed elver release sites for operational trials by the transfer team during the 2026/27 trap-and-transfer season. Estimated travel times from the Duncraigen Road elver trapping site are included to assist in assessing transfer logistics and site accessibility. All locations are at bridges or within 20 m of road access.

Catchment	Site	Latitude	Longitude	Travel time (min)
Manapōuri	Parallel Channel	−45.612037°	167.688593°	10–15
Manapōuri	Home Creek	−45.573023°	167.619888°	15–20
Manapōuri	Pearl Harbour	−45.569251°	167.609221°	10–15
Manapōuri	Frasers Beach	−45.557000°	167.620015°	10–15
Manapōuri	Forest Burn	−45.502019°	167.653056°	15–20
Mararoa	Lower Whitestone	−45.526791°	167.755116°	10–15
Mararoa	Upper Whitestone	−45.386573°	167.905271°	30–35
Mararoa	The Key	−45.541116°	167.887853°	15–20
Mararoa	Upper Mararoa	−45.503322°	167.977701°	25–30
Te Anau	Marakura	−45.427182°	167.715177°	25–30
Te Anau	Boat Ramp	−45.412087°	167.706198°	25–30
Te Anau	Fiordland Lodge	−45.376458°	167.757412°	30–35
Te Anau	Ciaffoni Landing	−45.362251°	167.754293°	30–35
Te Anau	North Ewe Burn	−45.306605°	167.785831°	35–40
Te Anau	Swamp Creek	−45.203466°	167.821747°	45–50
Te Anau	Mistletoe	−45.197400°	167.825172°	45–50
Te Anau	Retford Stream	−45.186825°	167.875025°	50–55
Te Anau	Totara	−45.076768°	167.984203°	60–65
Te Anau	Mackay Creek	−45.070851°	167.990481°	60–65
Te Anau	Eglinton East	−45.051368°	168.010565°	65–70

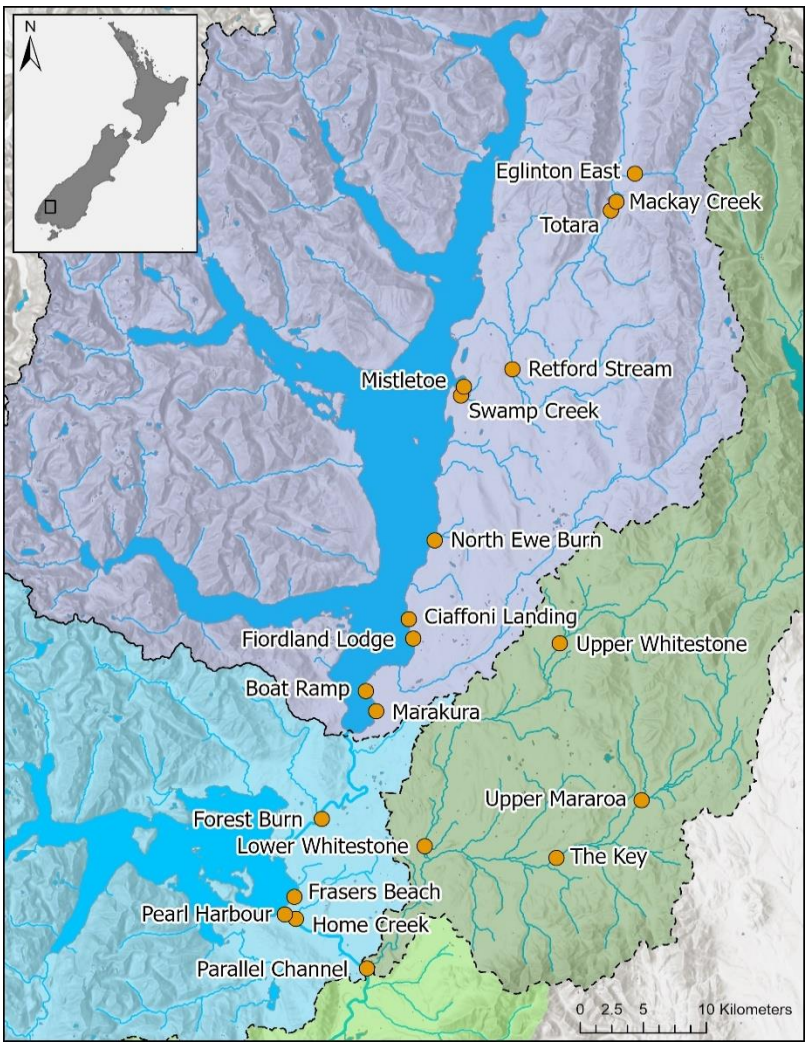


Figure 4.2 Proposed elver release sites for operational trials by the transfer team during the 2026/27 trap-and-transfer season. The proposed release sites are intended to increase the distribution of elvers throughout the catchment, especially in the Manapōuri and Mararoa catchments.

A key output from this assessment should be an estimate of the costs associated with servicing additional sites, together with an evaluation of any likely effects on elver condition, survival and post-release performance. The sites identified in Table 4.1 are all located within approximately 70 minutes' drive of the trapping site. Available evidence suggests that transport duration alone (particularly within this range) is unlikely to substantially affect elver survival, provided water quality is maintained, and appropriate fish-handling practices are followed. Consequently, moderate increases in transport distance to road-accessible release sites are unlikely to materially reduce release success.

At this stage, the programme should prioritise road-accessible sites. Helicopter-assisted transfers could provide access to more remote parts of the catchment, but would involve substantially greater cost, more handling and greater operational complexity. Such options should only be considered where suitable habitat has been confirmed, natural dispersal of elvers transferred elsewhere in the catchment to the identified sites is proven to be insufficient, and practical road-accessible alternatives are unavailable.

4.4 Prioritise release sites based on ecological and operational benefit (Year 1–2)

Information gathered during the Year 1 assessments should be used to evaluate and rank both existing and potential release sites. This assessment should integrate field observations, desktop analyses of existing datasets, and habitat assessments and modelling.

Sites should first be screened for operational feasibility and then evaluated according to:

- habitat suitability for eel growth and survival;
- likely carrying capacity[2];
- risk of localised density–dependent effects[2]; and
- the likelihood that stocked eels will contribute to silver eel production and successful escapement from the catchment.

Emphasis should be placed on identifying sites that are likely to contribute strongly to future escapement, such as suitable habitats within the Mararoa catchment.

The outcome of this process should be a ranked network of release sites that integrates both operational practicality and ecological benefit. This will provide a transparent basis for future stocking decisions and ensure that site selection is aligned with programme objectives.

4.5 Review catchment–level proportional distribution of elver transfers (Years 1–2)

In the short term, elver trap–and–transfer operations should continue to use the agreed baseline allocation while the expanded release–site network is assessed, trialled, and prioritised. Under this approach, approximately one–third of transferred elvers should be released within the Lake Manapōuri catchment and two–thirds within the Lake Te Anau catchment, with daily catches of less than 2 kg released into the Mararoa River where operationally feasible.

This allocation should be treated as an interim arrangement rather than a fixed long–term distribution. Once information from the Year 1 and Year 2 assessments becomes available, catchment–level allocations should be reviewed through the adaptive management framework. The review should consider habitat suitability, carrying capacity, post–release survival, dispersal, and the expected contribution of each catchment to future silver eel production and escapement.

Particular consideration should be given to the Mararoa catchment because eels stocked there may have a greater probability of successful escapement than those released into lakes Manapōuri and Te Anau. As monitoring results and site–prioritisation information are progressively incorporated, the allocation strategy should be updated to define transparent release proportions for the Mararoa, Manapōuri, and Te Anau catchments.

[2] Establishing carrying capacity and density–dependent effects across a range of sites may require >1–2 years, but should still be given consideration at this stage. See Section 5.1 for further discussion of required monitoring.

This will ensure that annual stocking decisions remain aligned with both ecological benefit and operational feasibility.

4.6 Implement an expanded and adaptive stocking strategy (Years 2–3)

From Year 2 onwards, stocking should be implemented through the ranked release–site network developed from the Year 1 assessments. Subject to any required approvals, sites that are both operationally feasible and ecologically suitable should be progressively incorporated into the annual transfer programme.

Annual elver allocations should then be distributed across this network using a transparent decision process that considers habitat suitability, carrying capacity, access, and the likely contribution of each site to future silver eel production and escapement. Allocation decisions should remain flexible: higher–priority sites may receive larger numbers of elvers less frequently or smaller numbers more frequently, while lower–priority sites may be stocked opportunistically where this supports monitoring needs, habitat use, or other management objectives.

This adaptive approach would spread stocking effort more effectively across the catchment, reduce the risk of localised density–dependent and predation effects, and improve the use of available habitat. By linking operational feasibility with habitat quality and escapement potential, the programme can focus additional effort where it is most likely to increase long–term recruitment to the spawning population, rather than simply increasing local eel abundance.

5 Monitoring priorities

The proposed monitoring programme should follow the adaptive management pathway outlined in Figure 3.1, with monitoring initially focused on the stages of the stocking process where uncertainty is greatest and where meaningful information can be collected within relatively short timeframes. Early investigations should seek to confirm that transferred elvers survive release, disperse into suitable habitats, and successfully recruit to receiving populations. Over time, monitoring can shift toward evaluating whether these outcomes translate into measurable improvements in population status and silver eel production and escapement. Development of detailed monitoring methodologies and implementation plans will be required for each of these priorities and should both inform, and be informed by, the location of current and future additional release sites.

5.1 Short-term monitoring priorities (Years 2-3)

Short-term monitoring should focus on understanding the immediate outcomes of transfer and stocking activities. Information collected during this phase will provide the evidence required to refine stocking methods, optimise site selection, and improve the effectiveness of the programme.

5.1.1 Priority 1: Survival during and following transfer

Are transferred elvers surviving capture, transport, and release?

Post-release survival is the first critical step in the stocking pathway. Mortality during capture, transport, or shortly after release directly reduces the number of individuals available to recruit into receiving habitats and contribute to future population recovery. Monitoring should focus on quantifying short-term survival, assessing handling and transport protocols through PIT-tag studies, evaluating relationships between transport conditions and survival, and comparing outcomes among release sites where practical.

5.1.2 Priority 2: Dispersal and habitat utilisation

How do transferred elvers disperse from release sites and what habitats do they utilise?

Understanding dispersal is necessary to determine whether stocking is achieving catchment-wide recruitment or simply concentrating eels near release locations. Monitoring should focus on movement patterns, dispersal distances, and habitat use through PIT-tag studies, mark-recapture programmes, and targeted population surveys undertaken at varying distances from release sites.

5.1.3 Priority 3: Recruitment and habitat carrying capacity

Are receiving habitats supporting successful recruitment and are stocking densities appropriate?

Habitat suitability and carrying capacity are widely recognised as key drivers of stocking success. Understanding existing eel abundance, habitat quality, and carrying capacity is, therefore, essential for determining whether stocking effort is being directed efficiently among sites. Monitoring should include assessments of eel density, biomass, age structure, and spatial distribution, together with evaluations of habitat extent, habitat

quality, food availability, and refuge availability. The results should be used to guide future decisions regarding stocking intensity and frequency, and release–site selection.

5.2 Long–term evaluation of programme effectiveness (Years 3–10+)

Long–term monitoring should focus on determining whether short–term recruitment outcomes translate into measurable ecological benefits for the longfin eel population. These investigations will help evaluate whether the programme is contributing to its overarching objective of supporting long–term population maintenance and improvement.

5.2.1 Priority 4: Population maintenance and improvement

Are stocked elvers contributing to increases in adult abundance, biomass, and population resilience?

Improvements in population structure, abundance and biomass provide important intermediate indicators of programme success. Monitoring should, therefore, focus on repeat population surveys, long–term trend analyses, and assessments of age structure and biomass to determine whether stocked cohorts are contributing to measurable improvements in recipient populations over time.

5.2.2 Priority 5: Silver eel production

Are stocked habitats contributing to the production of mature migrant eels?

Production of silver eels represents the final biological outcome expected from successful recruitment, survival, and growth within receiving habitats. Monitoring should focus on evaluating the contribution of stocked habitats to silver eel production through, for example, population monitoring, mark–recapture studies, PIT–tagging programmes, maturation assessments, and silver eel production modelling where appropriate.

5.3 Integration with broader programme monitoring

While silver eel escapement is ultimately the key determinant of contribution to spawning, monitoring escapement occurs at a broader spatial scale than the stocking programme alone and should be considered within the wider Migrant Eel Mitigation Programme. Information generated through the stocking programme should, therefore, be integrated with catchment–scale monitoring of downstream migration, trap–and–transfer effectiveness, and silver eel escapement to support evaluation of the overall mitigation programme.

Together, these monitoring priorities provide a framework for progressively evaluating each stage of the stocking pathway, from release through to silver eel production and escapement. Results should be used to adapt stocking densities, release–site selection, and catchment allocation over time, ensuring that management decisions remain evidence–based and that the programme continually improves its contribution to longfin eel recovery.

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