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Navigating Interdisciplinary Seas: Practical Pathways From and For Early-Career Marine Scientists

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Abstract

Navigating inter- and transdisciplinary marine research remains challenging for many early-career researchers (ECRs), who often receive limited practical training in cross-disciplinary collaboration, community engagement, and the science–policy interface. Drawing on our experiences as marine biologists in France, Portugal, and the United Kingdom, this article offers practice-oriented reflections and guidelines for ECRs in diverse institutional and socio-cultural contexts. Through a reflexive, experience-driven approach, we identify five key competencies for effective inter- and transdisciplinary work: communicating across disciplines and with diverse audiences, co-designing research with communities and non-academic partners, navigating institutional and cultural differences, ensuring safety and well-being, and building resilience. We then examine how funding, language, and institutional culture shape whether ECRs can exercise these competencies, identifying strategies that transfer between our three national contexts and those that require adaptation. We discuss approaches for selecting supportive mentors, building equitable teams, and practising reflexivity about positionality in collaboration. We conclude with actionable recommendations that ECRs, supervisors, training programmes, and funding agencies can use to foster more inclusive, reflexive, and impactful inter- and transdisciplinary careers and future leaders in sustainable ocean stewardship.

Keywords

co-design; early-career researchers; interdisciplinary research; ocean literacy; ocean stewardship; resilience; science–policy interface; transdisciplinary research

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1. Introduction

Early-career researchers (ECRs) are usually defined as scientists within the first 10 years of their research careers, from postgraduate students to postdoctoral fellows and junior lecturers. The UN Decade of Ocean Science for Sustainable Development (2021–2030) treats Early Career Ocean Professionals (ECOPs) as central to its delivery: It endorsed a dedicated ECOP Programme, now a global network of regional nodes and national hubs (Roman et al., 2024), and draws on ECOPs' own priorities for ocean sustainability (Satterthwaite et al., 2025), since today's ECRs will sustain the Decade's outcomes beyond 2030. Most ECRs, however, face heavy workloads, short-term contracts, and intense pressure to publish and secure funding. These pressures are particularly acute in inter- and transdisciplinary projects, which take longer to yield outputs, demand time to learn other disciplines' concepts and to build relationships with partners, and are often undervalued by discipline-based evaluation and funding (Apine et al., 2026; Bromham et al., 2016; Rölfer et al., 2022). Yet complex, interconnected ocean crises such as climate change, warming, and acidification require marine scientists to collaborate with other natural scientists, social scientists, and humanities scholars, among others, and with non-academic actors (Vozzo et al., 2025).

The terms multi-, inter-, trans-, and cross-disciplinary are often used interchangeably, although each implies a different level of integration between disciplines and a different relationship with non-academic actors, and therefore calls for different competencies. We use them as defined by Hayden-Nygren et al. (2025):

- Multidisciplinary research draws on disciplines working in parallel, each keeping its own concepts and methods.
- Interdisciplinary research integrates concepts, methods, and data into a shared analysis.
- Transdisciplinary research co-produces knowledge with non-academic actors.
- Cross-disciplinary research is the umbrella term for all three.

We use "competencies" for the knowledge, skills, and attitudes that researchers mobilise in practice and develop through hands-on experience. Their demands escalate with the depth of integration: Multidisciplinary work mainly requires coordination and clear communication across parallel workstreams; interdisciplinary work adds the ability to learn and combine other disciplines' concepts and methods; and transdisciplinary work further requires engaging non-academic partners, negotiating values and power, and sharing control over research questions (Hayden-Nygren et al., 2025; Norström et al., 2020). While academic programmes traditionally focus on technical "hard" skills, non-technical "soft" skills, including teamwork, networking, project management, communication, stakeholder engagement, and leadership, are increasingly recognised as equally vital in inter- and transdisciplinary contexts (Mason & Merga, 2022). Most ECRs report that these skills are poorly covered in curricula, and many learn them "on the job," which adds to the stress and uncertainty of a competitive professional environment (Mason & Merga, 2022; Nicholls et al., 2022). Institutional commitments such as the UK Researcher Development Concordat formalise entitlement to professional-development time, but implementation is uneven and rarely addresses inter- and transdisciplinary competencies. Moreover, the work of integration often falls on ECRs themselves, whose supervisors may be disciplinary experts with little training in collaborative research. Growing expectations of flexibility, mobility, and continuous output add risks of overload, poor mental health, and burnout (Gushulak et al., 2023; Nicholls et al., 2022).

As ECRs ourselves, we have first-hand experience of these challenges. The aim of this article is to translate these collective insights into practical pathways for ECRs, supervisors, training programmes, and funding agencies. Specifically, we will: (a) outline five key competencies for inter- and transdisciplinary marine research; (b) examine how structural conditions shape their exercise across our national and institutional contexts; (c) discuss strategies for building supportive, equitable, and reflexive teams and networks; and (d) synthesise these into actionable recommendations for ECR development, supervisory practice, and programme design. In doing so, we position ECRs not only as trainees adapting to a new research landscape, but as active shapers of emerging norms and practices in marine science. The common thread is a dual focus on competencies and conditions: what ECRs can learn and do, and what supervisors, programmes, institutions, and funders must change. Though drawn from the marine natural sciences, these pathways may also resonate with ECRs in other fields, including the social sciences and humanities.

2. Conceptual and Methodological Approach

This article adopts a reflexive, experience-based, practice-oriented approach rather than a conventional empirical design. Rather than relying on systematically collected datasets or hypothesis testing, it synthesises the authors' lived professional experiences across institutional and national contexts into transferable, practice-oriented insights. Such reflective contributions have a recognised role in advancing capacity development for the UN Ocean Decade (Vozzo et al., 2025).

We are three early-career marine biologists based in France, Portugal, and the United Kingdom, at master's-to-doctoral stages of our research careers, whose diverse institutional, cultural, and socio-economic environments offer a comparative lens on inter- and transdisciplinary practice. The material informing this article is drawn from professional and training experiences both received by us as trainees and designed and delivered by us as practitioners, including community-based conservation programmes, citizen science initiatives, science communication activities, ocean literacy projects, and engagement with the science–policy interface at multiple governance levels. Our perspectives are situated within European research systems (we use "Europe" in a geographical sense, including the United Kingdom); we therefore also draw on published ECR accounts from other regions (e.g., Partelow et al., 2020; Ramírez-Castañeda, 2020). Where we draw directly on our experiences, we present them as short mini-cases that state which of us was involved before connecting the experience to the literature.

We compared these experiences in two phases (Figure 1). First, during a one-week in-person meeting, each of us documented our experiences against a common set of guiding questions, and we then discussed and wrote iteratively together to identify shared themes, differences between our contexts, and the competencies each experience had required. Second, over the following six months, regular online meetings allowed us to share progress and connect our experiences to the literature. Being low-cost, largely remote, and peer-led, the process is readily replicable by other ECR groups. It brought forward experiential knowledge often overlooked in formal competency frameworks, that is, the codified skill inventories used by programmes, funders, and professional bodies (e.g., Apine et al., 2026; Strand et al., 2022).

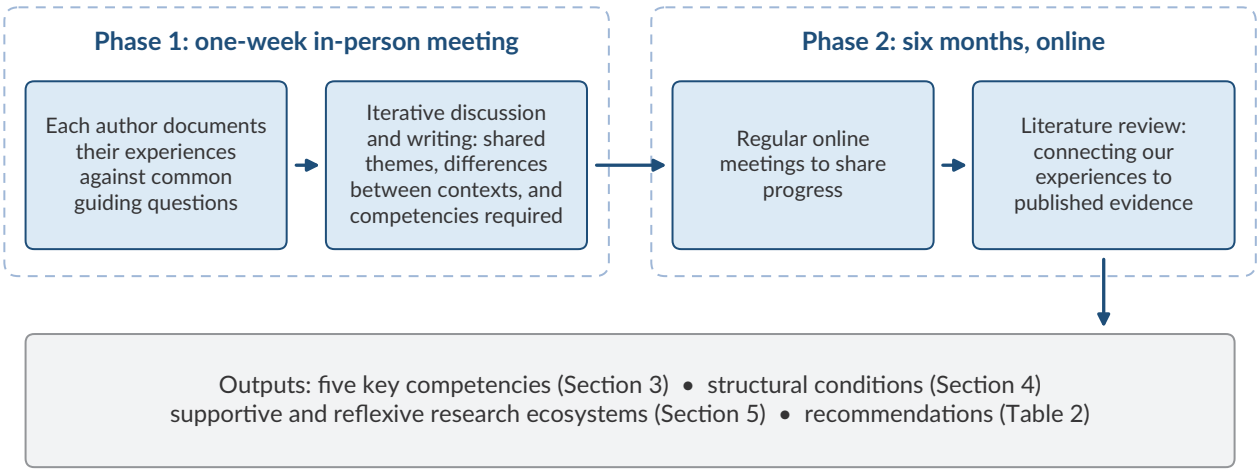

Figure 1. The two-phase collaborative process through which we compared our experiences and derived the competencies, structural conditions, and recommendations presented in this article.

2.1. Positionality

All three of us were trained in the natural sciences within European universities and engage with social-science concepts such as co-production and positionality as practitioners rather than specialists. Our group includes non-native English speakers working in Portuguese and French.

3. Key Competencies for Inter- and Transdisciplinary Work

Each of the five subsections below names its key competencies, illustrates them with our own experience where relevant, and ends with practical tips. ECRs' room for manoeuvre is bounded by power dynamics and structural constraints such as short-term contracts: The practical tips assume moments of agency, and Sections 4 and 5 address those structural constraints.

3.1. Communicating Across Disciplines and With Diverse Audiences

Marine research that aims to inform the management of societal and sustainability problems, such as migratory fish conservation or invasive species management, typically integrates ecology, hydrology, chemistry, the social sciences, and policy. The key competencies here are framing research for different audiences, active listening, and navigating differences in vocabulary, values, and power, within academia and beyond. ECOPs rank connecting different knowledge systems among the most urgent priorities for the UN Ocean Decade (Vozzo et al., 2025). Yet crossing disciplinary boundaries is consistently reported among the most significant barriers for ECRs (Apine et al., 2026; Rölfer et al., 2022; Strand et al., 2022), and most ECRs wish to communicate beyond academia but lack training, self-efficacy, and opportunities to observe peers doing so (Mason & Merga, 2022). The disciplines named above all belong to the Western scientific tradition; communicating with holders of other knowledge systems, such as Indigenous, local, and traditional knowledge, raises distinct questions of equity, which we address in Section 5.3.

Each audience brings distinct vocabularies, priorities, expectations, and value systems. For example, a regulator, a fisher, and a conservation non-governmental organisation (NGO) may weigh the same evidence

differently. In our own work, we routinely navigate technical assessments with field technicians, regulatory discussions with managers, and translation for conservation NGOs and local communities. As Cazé et al. (2023) show, this navigation also implies engaging with the power asymmetries that shape whose knowledge is heard and acted upon. ECRs face these asymmetries twice: between the actors they bring together, and within their own institutions, where their junior position limits how openly they can challenge senior colleagues or partners.

3.1.1. Mini-Case Study: Communicating Invasive-Species Control Through Gastronomy

Within the CHALLENGER SILURO project on controlling the European catfish (*Silurus glanis*) in the River Tagus, a team including one of the co-authors combined environmental biology, gastronomy, and environmental education. Reaching anglers and the public at culinary demonstrations and tastings required framing the invasive predator in terms of culinary heritage and sustainability rather than ecological indices. Control relied on culinary demand and public acceptance, so partners also had to understand why reducing the population mattered ecologically (Gago et al., 2025). This illustrates the difficulty of navigating the conflicting value systems of non-academic actors without adequate institutional preparation (Rölfer et al., 2022).

Schools and policymakers deserve particular attention. In schools, place-based and inquiry-based approaches improve students' ocean knowledge and connection to local marine environments (Freitas et al., 2026). Such engagement is itself interdisciplinary: Partnering with ECRs in education brings pedagogical expertise that marine scientists rarely hold. With policymakers, communication benefits from structured formats such as co-designed dialogues, scenario-based workshops, and iterative consultation (Heidenreich et al., 2025). ECR-led associations offer entry points: Through the Association of Polar Early Career Scientists, for example, ECRs have contributed to reviews of Intergovernmental Panel on Climate Change reports (Moreno-Ibáñez et al., 2024). In both cases, communication works best when built into the research process from the outset, for instance by co-developing school materials with teachers during project design, or by agreeing policy-relevant questions with managers before analyses begin.

3.1.2. Practical Tips

To communicate across disciplines and with diverse audiences, we suggest the following:

- Build narratives with, not just for, your audiences: Start from conversation with interested parties to understand their interests and values relative to your research aims, then develop tailored versions for specialist peers, informed non-specialists, and the general public (Mason & Merga, 2022).
- Ask, do not assume: Before presenting, ask what the audience already knows and attend to their "prior conceptions" (Morin, 2021), adjusting for age, since communicating with adults differs from children in vocabulary, complexity, and approach. Unexamined assumptions breed jargon or over-simplification.
- Use local and concrete examples: Anchor abstract concepts in familiar species, rivers, or events; with managers and policymakers, lead with the implication, not the method (Karcher et al., 2024).
- Collaborate with science communicators and boundary-spanners (journalists, museum educators, NGO communicators): They spot communication gaps that disciplinary training rarely reveals (Karcher et al., 2024).

- Seek out cross-disciplinary spaces: Workshops, working groups, and summer schools convening multiple disciplines build communicative flexibility (Vozzo et al., 2025).

3.2. Co-Designing Research With Communities and Non-Academic Partners

Co-design, in which researchers and non-academic partners (including NGOs) jointly frame the questions, methods, and uses of research, lies at the core of transdisciplinary work. It can follow several methodologies, from participatory action research, in which researchers and participants define problems, act, and reflect in iterative cycles (Cornish et al., 2023), to broader knowledge co-production approaches, participatory mapping, and community-based monitoring (Norström et al., 2020). Whatever the methodology, local partners are experts in the systems in which they live and work, not merely a means of access to research sites, and co-design requires long-term mutuality rather than episodic consultation (Norström et al., 2020). Ocean literacy and citizen science, the fields in which we work, offer accessible entry points for ECRs. Ocean literacy, understanding the ocean's influence on people and people's influence on the ocean, is a foundational goal of the UN Ocean Decade, increasingly framed as an outcome, a measurable change in society's relationship with the ocean, rather than a one-way transmission process (Glithero et al., 2026); it helps people recognise their own agency in shaping ocean health. Citizen science extends data collection to temporal and spatial scales otherwise inaccessible to short-funded projects, but it is also a vehicle for public participation in science and for collaboration between scientists and non-scientists, ranging from contributory projects, in which volunteers collect data, to co-created ones, in which participants help define questions, design methods, and interpret results (Fraisl et al., 2022).

Co-design requires careful planning to deliver mutual benefits. Participatory action research is most effective when relationships, working practices, and a shared understanding of the issue are established before data collection begins (Cornish et al., 2023), and a review of 337 participatory marine conservation studies identifies two-way communication, attention to power imbalances, and longer funding cycles as decisive (Ison et al., 2024). At full scale, Rangel et al. (2025) describe a three-year participatory process to co-design a Marine Protected Area of Community Interest in southern Portugal, endorsed by 96% of involved stakeholders, showing that co-design is feasible even in densely populated, multi-use coastal contexts given transparent procedures. In our own experience in Portuguese river basins, durable relationships required sustained presence, reciprocal exchange, and respect for local knowledge. Citizen-science data also carry well-documented biases from participation, detectability, and observer preference (Johnston et al., 2023), and participation is itself uneven, with projects concentrating in higher-income countries (Deacon et al., 2023): Who can take part is itself a design question. For ECRs, co-design therefore demands engagement skills, relationship- and trust-building with partners, and methodological rigour. Above all, it should be guided by partners' needs, priorities, and knowledge rather than solely by researchers' questions, as Indigenous-led and community-partnered programmes demonstrate; the researcher's first task is listening (Norström et al., 2020).

3.2.1. Mini-Case Study: Ocean Literacy Through SeaVoice

One of the co-authors volunteers remotely with SeaVoice, a multimedia storytelling platform amplifying underrepresented ocean voices, supporting partnerships, social-media outreach, and grant writing. The role illustrates Gerhardinger et al.'s (2024) point that peer-led, distributed, media-rich learning networks can build

capacity that traditional academic settings rarely offer; through it, the co-author has developed communication, partnership, and project-management skills transferable to ocean-policy contexts. The link to co-design is direct: Negotiating shared goals and mutual benefit with contributors and partners is precisely the relationship- and trust-building on which co-design depends.

3.2.2. Practical Tips

To co-design research with communities and partners, we suggest the following:

- Choose a co-design methodology that fits the partnership, from participatory action research to community-based monitoring: Ocean-literacy and citizen-science networks (e.g., blue-school programmes, ECOP nodes) offer entry points without formal grant funding (Costa & Faria, 2025; Gerhardinger et al., 2024; Roman et al., 2024).
- Co-design before you collect: Establish shared framing, expectations, and feedback loops with partners before sampling (Cornish et al., 2023; Ison et al., 2024; Norström et al., 2020).
- Be honest about what your methods can and cannot do: Volunteer datasets, for example, are powerful for large-scale trends but should not replace systematic surveys; honesty about such limits maintains the trust on which co-design depends (Fraisl et al., 2022).
- Close the feedback loop: Share findings and outcomes with the communities that took part in or were affected by your research (Karcher et al., 2024).
- Create your own entry points where none are advertised: Contact NGOs, learning networks, and ocean-literacy initiatives directly, with concrete examples of your work.

3.3. Navigating Institutional and Cultural Differences

Inter- and transdisciplinary projects routinely span universities, research institutes, agencies, NGOs, and companies; the competencies this demands, including translating between sectoral logics, setting expectations explicitly, and building cross-sector relationships, are rarely taught. Institutional fragmentation is a barrier at two levels: to research, because partners operate under different timelines, incentives, and accountability structures, and to career progression, because each institutional type rewards different outputs, so that cross-sector work may count in one setting and go unrecognised in another (Apine et al., 2026). In our experience, marine and freshwater science spans universities, research institutes, polytechnics, agencies, NGOs, and consultancies, each with distinct funding logics, hierarchies, and norms around productivity, engagement, and career progression.

For one of the co-authors, whose early career spans a university, a research institute, a polytechnic, and a consultancy alongside leading an NGO, these differing currencies made the barrier concrete: A research institute emphasises peer-reviewed publications, competitive funding, and international networks; a consultancy values robust, actionable deliverables on tight deadlines; and an NGO balances scientific credibility with community trust, local politics, and the expectations of funders and volunteers. These emphases are tendencies rather than absolutes, but learning to recognise and translate between them is the competency at stake, and ECRs who can do so are well placed to become change agents, provided support structures exist (Vozzo et al., 2025).

3.3.1. Practical Tips

To navigate institutional and cultural differences, we suggest the following:

- Research the institutional culture before joining: Ask current and former members about informal norms, publication expectations, and how ECR contributions are recognised; such information rarely appears in job descriptions (Apine et al., 2026).
- Be explicit about expectations from the outset: In cross-institutional collaborations, align early, in writing, on authorship norms, data ownership, communication timelines, and decision-making; ambiguity is a consistent source of conflict (Nyboer et al., 2023).
- Build bridges across sectors: Proactively cultivate relationships across academia, NGOs, government, and the private sector; they are scientifically and professionally valuable, even when uncomfortable to initiate (Karcher et al., 2022). Where short contracts limit control over time, even small steps—one conversation, one cross-sector seminar—keep bridges alive; Section 4 and the Conclusion address the structural side.

3.4. Ensuring Safety and Well-Being

Marine fieldwork involves physical hazards, from fast-flowing rivers and estuarine boat expeditions, as in our own work, to offshore campaigns, scientific diving, and laboratory work, and social-science field techniques carry their own risks, from emotionally demanding interviews to lone working. For ECRs, often the least experienced members of field teams, robust safety practices are a personal and collective responsibility. The key competencies (i.e., risk assessment, clear team communication, boundary-setting, and the confidence to raise concerns) are also foundational to inter- and transdisciplinary collaboration, which multiplies the settings and teams an ECR must navigate. Yet physical safety is only one dimension of well-being in field and engagement settings. Gushulak et al. (2023) describe a "silent mental health crisis" among ECRs in aquatic sciences, driven by job and financial insecurity, extreme competition, toxic power dynamics, isolated fieldwork, impostor syndrome, and productivity guilt. Nicholls et al. (2022) find that job insecurity coupled with high academic expectations places ECRs at significant risk of poor mental health; peer support, mentorship, and opportunities for career progression can help to mitigate this risk, but they are not a substitute for systemic institutional change. The "pushing through" culture of many field teams can make it harder for ECRs to raise concerns, a dynamic Gushulak et al. (2023) link to mental-health difficulties.

3.4.1. Practical Tips

To protect safety and well-being, we suggest the following:

- Never skip the risk assessment, even for routine fieldwork: Documented protocols protect the entire team. Make sure everyone knows the reporting procedures for emergencies, harassment, and other critical situations, and keep safety training up to date.
- Know your limits and communicate them: If an activity feels unsafe, say so. Psychological safety, raising concerns without professional penalty, matters as much as physical protocols.
- Normalise talking about mental health: Make brief well-being check-ins standard team practice (Gushulak et al., 2023).

- Build peer-support networks proactively, before crises arise: Peer support is among the most effective mitigators of academic stress (Martin et al., 2023; Nicholls et al., 2022). In collaborative projects, these networks double as safe channels for raising concerns across institutional boundaries.

3.5. Building Resilience

Resilience runs through the challenges described above, and we consider it a core competency for inter- and transdisciplinary work rather than a personal trait. Following resilience research, we understand it as the capacity to adapt positively to adversity over time, drawing on individual, relational, and institutional resources rather than on endurance alone (Southwick et al., 2014; Ungar, 2011). Integrative work is slower to yield recognised outputs and less likely to be funded (Bromham et al., 2016); it exposes ECRs to repeated critique from reviewers and partners with different expectations; and it often lacks a single disciplinary "home" that provides recognition and peer support (Apine et al., 2026; Rölfer et al., 2022). For ECRs, precarity compounds these pressures: Short contracts leave little time to build the relationships on which both collaboration and recovery from setbacks depend (Gushulak et al., 2023). Because resilience depends on the resources an environment provides, supervisors and institutions share responsibility for it, for example by protecting time for engagement and normalising discussion of setbacks. The competencies involved are therefore relational as much as individual: building support networks before they are needed, setting boundaries on workload, interpreting setbacks in their structural context, and judging when to adapt to a constraint and when to challenge it. Framing resilience in this way guards against a risk we take seriously: that resilience becomes a demand placed on individuals in place of the institutional reform discussed in Sections 4 and 5 (Nicholls et al., 2022).

3.5.1. Practical Tips

To build resilience, we suggest the following:

- Build resilience infrastructure before you need it: A regular peer group, a mentor outside your institution, and non-work anchors are protective (Martin et al., 2023; Nicholls et al., 2022).
- Reframe rejection as structural, not personal: Interdisciplinary proposals face lower funding success (Bromham et al., 2016), so setbacks are statistically normal; debrief them with peers (Gushulak et al., 2023).
- Set boundaries deliberately: Agree in advance how much time engagement and cross-disciplinary learning will take, and protect it from being absorbed into unpaid overtime.
- Recognise when to adapt and when to challenge: Resilience should not mean absorbing every structural constraint; Section 4 suggests where collective advocacy is more effective than individual endurance.

4. Situating Inter- and Transdisciplinary Work in National and Institutional Contexts

The challenges of inter- and transdisciplinary marine science are shaped by where researchers work: geographically, institutionally, and linguistically. Knowledge production in marine sciences is patterned by path dependencies in which North American, European, and Australian programmes shape the global agenda (Partelow et al., 2020). This section situates the competencies of Section 3 in the structural conditions that determine whether ECRs can exercise them: funding (Section 4.1), language (Section 4.2), and institutional

culture (Section 4.3), before drawing the lesson of what transfers and what requires adaptation (Section 4.4), comparing not countries but how these conditions manifest across the settings we know directly in France, Portugal, and the United Kingdom.

4.1. Structural and Funding Disparities

Marine research funding is concentrated in North America and northern and western Europe (Partelow et al., 2020). This concentration enables "parachute science," in which researchers from well-funded institutions design and lead studies in biodiversity-rich but resource-limited regions without meaningful local involvement (de Vos, 2022; Stefanoudis et al., 2021). Parachute science is therefore not only a matter of funding flows but of positionality and research design: Who frames the questions, who is listed as author, and whose knowledge counts are decided at the design stage, which is where ECRs can most usefully intervene (Section 5.3). In Portugal and France, stable positions concentrate in major institutes, and the precarity of short-term contracts is compounded, for ECRs in polytechnics, NGOs, and consultancies, by limited access to research infrastructure (Apine et al., 2026).

4.2. Language as a Structural Barrier

Language shapes who can take part in, and lead, inter- and transdisciplinary work. Non-native English speakers spend significantly more effort on reading, writing, and presenting and more often withdraw from conferences and networks (Amano et al., 2023), and language-related rejections and translation costs, up to half a monthly doctoral salary in one survey (Ramírez-Castañeda, 2020), weigh heaviest on ECRs with the thinnest budgets. Yet transdisciplinary work with local partners is usually conducted in local languages, and non-English science carries real value, expanding the geographic coverage of conservation evidence by up to one quarter (Amano et al., 2021). For Iberian and Francophone ECRs leading such work, the result is a double burden: engaging partners in their own language while publishing in English, where locally relevant applied research rarely reaches high-impact journals, with a gradual erosion of the specialist vocabulary needed to teach and discuss science locally (Elnathan, 2021).

4.3. Institutional Culture

For ECRs, institutional differences matter directly: The same piece of work may count towards progression in one institution and go unrecognised in another. University–NGO collaborations often founder on divergent timelines, vocabularies, and accountability structures that are rarely made explicit at the outset, and similar friction arises between research institutes and government agencies, where political timelines and confidentiality rules sit uneasily with academic openness. ECRs, who frequently do the day-to-day work of such partnerships without the authority to renegotiate their terms, absorb much of this friction. Context-specificity is a core principle of co-production: Collaboration requires deliberate adaptation to each partner's institutional reality (Norström et al., 2020). Table 1 summarises each context's characteristics, the challenges it poses to ECRs undertaking inter- and transdisciplinary work, and strategies ECRs can use to overcome them. Coalition-building means assembling allies across units and sectors around a shared problem, so that an ECR's project does not depend on a single institution's priorities; in practice, this can take the form of co-supervision across institutions or a steering group that includes partner organisations. Navigating legitimacy means establishing credibility in settings that value different outputs, from

peer-reviewed papers in universities to timely deliverables in consultancies and community trust in NGOs; ECRs can build such credibility by planning at least one output valued by each partner.

Table 1. Institutional contexts for ECRs in marine and freshwater science: key characteristics, main challenges, and effective strategies.

Context	Key characteristics	Main ECR challenges	Effective strategies
Public university	Publication-driven; competitive grants; international networks	Publishing pressure; limited outreach time	Peer mentoring; interdisciplinary training; formal recognition of outreach
Research institute	Project-based; short contracts; output metrics	Employment precarity; limited time for engagement	Structured mentorship; open data; protected time for non-publication work
Polytechnic institution	Applied focus; regional relevance; teaching load	Limited funding; smaller networks	Applied research design; strong local stakeholder ties
Environmental NGO	Mission-driven; community-embedded; resource-constrained	Scientific credibility; funding instability	Participatory methods; trust-based relationships; rigour in non-academic formats
Private consultancy	Client-driven; tight deadlines; technical outputs	No publication pathway; disconnected from academia	Translation of fieldwork data into research outputs; framing deliverables as evidence
Cross-sector/NGO leadership	Bridges science and civic domains; public visibility	Credibility in scientific and advocacy arenas	Science communication; coalition-building; navigating legitimacy

4.4. What Transfers and What Requires Adaptation

In our experience, collaborations organised around a shared problem, such as controlling an invasive species, bridged institutional and national divides more readily than those organised around a shared discipline, consistent with the goal-oriented principle of knowledge co-production (Norström et al., 2020). Across our three national contexts, the strategies that transferred most readily for overcoming the ECR challenges described in Sections 3 and 4 were participatory co-design, peer-support networks, open-access communication, and explicit expectation-setting (Karcher et al., 2022; Martin et al., 2023; Norström et al., 2020). They transfer because they are relational and largely cost-free, depending on practices under researchers' own control rather than on particular funding schemes, metrics, or budgets. Others require adaptation: Publication-centric metrics are inaccessible in NGO and consultancy contexts; English-only dissemination excludes local audiences (Amano et al., 2023); and individual competitive funding disadvantages southern European and NGO-based ECRs. Overcoming these structural inequalities requires institutional and funding-level action, not only individual resilience (Section 3.5; Apine et al., 2026; Valdez et al., 2024). In practice, ECRs can use Table 1 to diagnose their setting, lead with the transferable strategies and adapt the rest, and, where they have standing, cite this structural evidence in ECR committees, surveys, and associations, so that resilience is not treated as a substitute for reform (Apine et al., 2026).

5. Building Supportive and Equitable Research Ecosystems

This section examines three components of the relational and structural ecosystem that shapes ECRs' inter- and transdisciplinary work: supervisory mentorship, equitable team-building, and positionality and reflexivity in collaboration.

5.1. Selecting and Working With Mentors

For most ECRs, the supervisor–supervisee relationship is among the most important determinants of research experience, productivity, and well-being, and the same principles extend to co-supervisors, committees, and external mentors (Wang et al., 2023). How supervisors are chosen matters: Attention to subject-matter expertise and supervisory track record predicts fewer interaction difficulties and greater supervisee confidence, whereas having no real choice is associated with poorer outcomes (Pavliuk & Zhuchkova, 2025). Where ECRs have a choice, publication records are an imperfect proxy for mentorship quality, since prolific supervisors may lead large groups with scarce mentoring time and group authorship practices can inflate records; supervision practices, mentoring time, and supervisee outcomes are better indicators, as are conversations with current and former supervisees and shared values and cultural awareness (Tuma & Dolan, 2024). In inter- and transdisciplinary research, a supervisor's openness to non-traditional outputs, such as policy briefs and community reports, and to time spent on communication and engagement substantially shapes an ECR's growth (Nyboer et al., 2023). Peer mentorship complements supervision, in that peers offer candid advice free of evaluative power and support from people facing the same pressures, and the two forms are strongest together (Martin et al., 2023; Wang et al., 2023).

5.1.1. Practical Tips

To select and work with mentors, we suggest the following:

- Build a peer-mentorship network from the start: Peer support complements supervisory support and is sometimes just as important (Martin et al., 2023).
- Assess a prospective mentor's inter- and transdisciplinary capacity: Look for work across disciplines and sectors and for valuing of non-traditional outputs (Nyboer et al., 2023).
- Seek feedback from current and former supervisees: Obtain their contacts independently of the supervisor to reduce bias.
- Manage expectations early: Agree supervision frequency, feedback timelines, and authorship norms in writing. Table your own expectations, too: fieldwork and conferences, training and voluntary activities, work–life balance and family commitments (Nyboer et al., 2023; Wang et al., 2023).
- Check the research output of the supervisor last, not first: A consistent publication record can reflect an active profile and co-authorship opportunities, but read it with the mentorship indicators above, not as a substitute for them (Pavliuk & Zhuchkova, 2025).

5.2. Building Trusted and Equitable Teams

Scientific knowledge production is largely, and in inter- and transdisciplinary settings unavoidably, collective, yet the dominant metrics of academic success, including individual publication records, citation indices, and

competitive grant awards, systematically obscure its collaborative nature. For ECRs in inter- and transdisciplinary settings, trusted, equitable teams are both a practical necessity and an ethical commitment. Ross et al. (2022) find that women in research teams are significantly less likely to be credited with authorship relative to their contributions, across most fields and career stages. Kaikkonen et al. (2024) establish that fostering diversity, equity, and inclusion in interdisciplinary marine science is not merely aspirational but an ethical imperative. Transdisciplinary work adds an authorship question academic norms rarely cover: how to recognise non-academic contributors equitably by agreeing, from the outset and with the aid of taxonomies such as CRediT, which contributions warrant authorship and which should receive named acknowledgement or other forms of benefit-sharing (Norström et al., 2020; Nyboer et al., 2023). A tension remains: ECRs usually join existing teams. ECRs can model equitable practice at their level, document contributions, and raise authorship early; building trusted teams matures with career stage, and seniors hold most of that responsibility. In the small, volunteer-based NGO that one of the co-authors leads, for instance, this means explicitly recognising each volunteer's contribution, since the team relies largely on volunteered time and expertise.

5.2.1. Practical Tips

To build trusted and equitable teams, we suggest the following:

- Make authorship discussions explicit and early: Agree criteria and contribution roles before work begins.
- Formally acknowledge non-authorial contributions: Credit technicians, students, community partners, and volunteers in publications, reports, and presentations.
- Model inclusive decision-making: Create space in meetings for less senior or more reserved members (Kaikkonen et al., 2024; Ross et al., 2022).
- Diversify your team intentionally: Seek collaborators from different disciplinary, institutional, and personal backgrounds (Kaikkonen et al., 2024).

5.3. Positionality and Reflexivity in Collaboration

Who designs, leads, and is credited in marine research reflects researchers' positionality: the disciplinary, institutional, geographic, and social positions from which they work, and which shape their questions, methods, and interpretations (Holmes, 2020). Inequitable practices show what happens when positionality goes unexamined. In "parachute science," studies in biodiversity-rich but resource-limited regions are published without meaningful local participation (de Vos, 2022; Stefanoudis et al., 2021); in "remote-control science," decision-making and authorship stay with Global North scientists absent from study sites (Dáttilo & Rivera-Núñez, 2025), and local ecological knowledge is often incorporated into publications without acknowledgement or benefit-sharing (de Vos, 2022). These patterns also reproduce within countries and within Europe, between well-funded and peripheral institutions, and are sustained by unequal access to funding, technology, and research infrastructure.

Reflexivity is the practice that turns awareness of positionality into action. It involves examining how one's position, assumptions, and interests shape whose knowledge is sought, cited, and credited, so that hierarchies framing Western science as the default become visible and can be dismantled (West et al., 2025). We use "reflexive" in this sense throughout. For ECRs in European institutions, reflexivity cuts both ways.

ECRs, ourselves included, are increasingly expected to model equitable practice in international collaborations—by budgeting for local capacity, ensuring fair authorship, and producing non-English outputs (Roch et al., 2025)—while being themselves, often as members of peripheral or non-anglophone institutions, subject to marginalising structures. Practising reflexivity therefore means asking, at each stage of a project, both whom their design may exclude and where their own position is constrained. Useful tools include the collective-responsibility framework of Valdez et al. (2024) and the explicit citation of Traditional Knowledge and its holders in bibliographies and contributor lists (Postigo, 2026).

5.3.1. Practical Tips

To practise reflexivity in collaboration, we suggest the following:

- Write a short positionality statement at project inception: Note your disciplinary, institutional, and geographic position, and revisit it at key decisions on questions, authorship, and dissemination (Holmes, 2020).
- Plan equity from the proposal stage: Budget for local salaries, training, and shared infrastructure, not only for travel and analyses (Valdez et al., 2024).
- Share control and credit with local partners: Co-define research questions with them and with other stakeholders, and agree fair authorship and credit-sharing from the outset (Roch et al., 2025).
- Use non-English-language outputs to close, not widen, the gap: Open-access summaries in the host community's language are a low-cost, high-impact action; budget explicitly for translation and for feeding results back to the communities and partners who hosted the research (Amano et al., 2023; de Vos, 2022).
- Cite locally and inclusively: Expand literature searches beyond anglophone databases (Amano et al., 2021).

6. Conclusion

The challenges of inter- and transdisciplinary marine research cannot be reduced to a checklist of competencies, nor solved by ECRs accumulating ever more skills. Two patterns emerge consistently across our experiences and evidence. First, the competencies most predictive of impactful inter- and transdisciplinary work, namely communicating across disciplines and with diverse audiences, co-designing research with communities and partners, navigating institutional and cultural differences, ensuring safety and well-being, and building resilience, are precisely those most under-supported in formal training (Apine et al., 2026; Vozzo et al., 2025). Second, the strategies that have proven most transferable across the national contexts we have examined, including peer-mentoring networks, participatory co-design, transparent expectation-setting, and multilingual dissemination, are all relational: They depend on cultivating trust over time, within teams, and with the communities, policymakers, and stakeholders whose ocean is at stake.

Table 2 translates these patterns into recommendations for each audience.

Table 2. Recommendations by audience.

Audience	Recommendations
ECRs	Prioritise communication and stakeholder engagement skills alongside methods; treat resilience as a competency built collectively (Section 3.5); seek transferable experience beyond marine science, where volunteering, societies, and adjacent fields offer equity-minded routes that unpaid internships often gate (Kaikkonen et al., 2024); invest early in peer communities and ECR networks (Roman et al., 2024).
Supervisors and mentors	Recognise outreach, engagement, and policy work as legitimate outputs; co-develop engagement plans rather than delegating them, sharing networks and absorbing risk in difficult interactions; guarantee a confidential route for raising concerns without penalty (Gushulak et al., 2023; Ison et al., 2024; Karcher et al., 2022).
Training programmes, institutions, and funders	Integrate inter- and transdisciplinary practice, co-production, and reflexivity into core curricula; provide dedicated funding lines, protected time, and updated impact metrics for engagement work; address structural inequities through equitable funding access, multilingual dissemination, anti-parachute policies, family-friendly measures (including caregiver funding at conferences), and accessible mental-health support (Strand et al., 2022; Valdez et al., 2024; Vozzo et al., 2025).

These findings carry implications that extend beyond ECRs. The science required to meet the goals of the UN Ocean Decade will not be produced if its contributors are systematically overworked, undervalued, isolated by language, or made to treat engagement, equity, and well-being as auxiliary (Satterthwaite et al., 2025; West et al., 2025). Supervisors, training programmes, institutions, and funders share responsibility for the conditions in which ECRs operate; the recommendations in Table 2 make that responsibility concrete. We offer this article both to the ECRs who will inherit these challenges and as a statement of accountability to ourselves. Our experiences are partial, situated, and inevitably shaped by privilege as well as constraint. They are not a universal template, but they are one example of how inter- and transdisciplinary marine science can be made more inclusive, more reflexive, and more durable, and an invitation to other ECRs to add their own.

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