7. Small-eyed ray (*Raja microocellata*)

*Irish name: Roc mionsúileach*

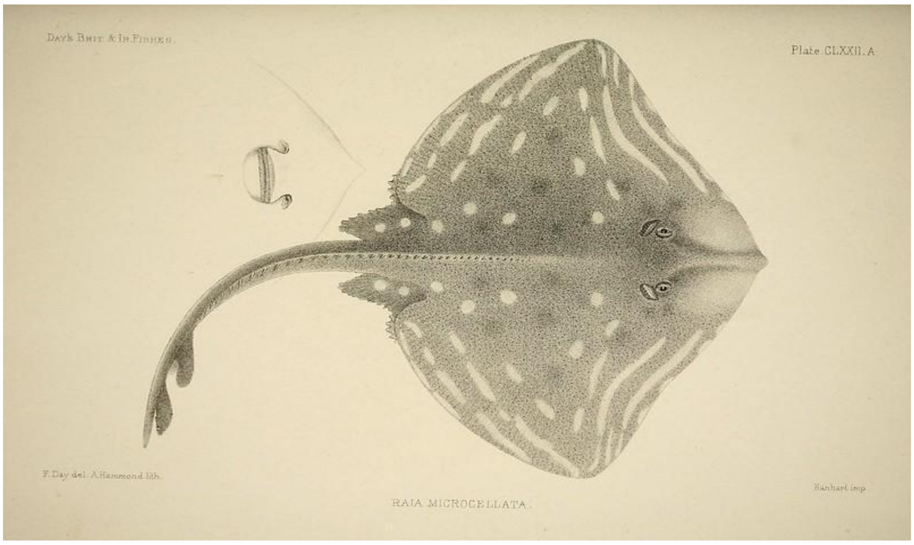


Figure A10.7.1. Small-eyed ray (*Raja microocellata*). Image from La Blanchère (1868)



**Background**

The small-eyed ray belongs to the Class Chondrichthyes. It can reach 91 cm total length and matures at approximately 60 cm (Ryland & Ajayi, 1984). There is uncertainty regarding the general ecology and reproductive biology of this species, although it is thought to lay eggs on sandy, muddy, or rocky habitats (Breder & Rosen, 1966; E. Farrell pers. comm. March 2024) and fecundity is estimated to be 54-61 eggs per year, with egg-laying broadly occurring from June – September (Ryland & Ajayi, 1984). Although egg-laying sites are unknown, research suggests hatched small-eyed rays occur in 'shallow' water (Gordon et al., 2016) and observations within Celtic Sea area of interest suggest a winter to spring spawning season (E. Farrell pers. comm. March 2024). Small-eyed rays range primarily along the Atlantic coastline of Northwest Europe to Northwest Africa (Stehmann & Bürkel, 1989). They are a benthic, inshore and shallow water species rarely encountered below 100 m, with juveniles thought to occur in shallower water when compared to adults (Ellis et al., 2005a). They are thought to be uncommon throughout their range, but abundant in certain coastal sandy areas such as the Bristol Channel (England), Bertheaume Bay (Brittany), and south-eastern Ireland (Fahy & O'Reilly 1990; Rousset, 1990; Ellis et al., 2005a,b). Although mostly encountered in sandy areas, the small-eyed ray is also known to frequent high-energy circalittoral rock (Simpson, 2018).

**The rationale for spatial protection in the southern Celtic Sea**

The small-eyed ray was nominated for inclusion with particular reference to its amenability to spatial protection and uncertainties regarding its population recovery. It is listed under the Irish Red List as Least Concern and under the IUCN red list as Near Threatened at the European and global scale. Under a long-term assessment, the Convention for the Protection of the Marine Environment of the North-East Atlantic or OSPAR convention has listed the small-eyed ray population as recovering in Irish waters and that further decline of the population has been prevented (Lynam et al., 2022). However, this assessment was based on deep-sea surveys, whereas small-eyed ray distribution has so far been shown to be more prevalent in coastal, shallow-waters. Additionally, a recent ICES assessment (ICES, 2022) highlights that although the species is managed under a Total Allowable Catch (TAC) of no more than 86 tonnes in the years 2023 and 2024 in divisions 7.f and 7.g, misidentification of the species occurs and an unknown quantity of discarding takes place, meaning accurate biomass estimates are unavailable. ICES also advises landings are lower than 2021-2022 advice in divisions 7.f and 7.g as the biomass index has declined, despite division 7.f, in particular, being known as a stronghold for the species (ICES, 2022). Furthermore, ICES advises that the time needed for the stock to recover is unknown (ICES, 2022), which is possibly because little is known about this species ecology and biology. However, it is thought that the presence of static gear (such as those associated with whelk fishing), provide some protection to juveniles which tend to remain more coastal as trawling effort might be lower in those areas (ICES, 2022).

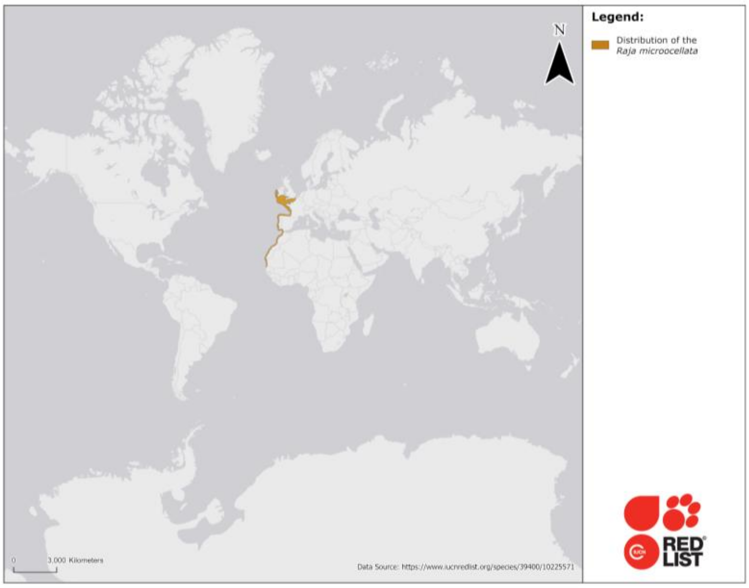


Figure A10.7.2. Global geographic distribution of the small-eyed ray (*Raja microocellata*). Taken from https://www.iucnredlist.org/species/39400/10225571

**Sensitivity assessment**

**Based on current knowledge, the small-eyed ray is amenable to spatial protection**. It is vulnerable to capture in trawls and gillnet fisheries as accidental bycatch (Ellis et al., 2005b; ICES, 2022). This species is known to frequent sandy areas and may spend extended periods in one location (Simpson, 2018). The small-eyed ray has also demonstrated a degree of site fidelity by returning to no more than 30 km away from the original tagging site (Plymouth, England) and more locally, to no more than 35 km from Tralee Bay where 249 small-eyed rays were tagged between 1971 – 2013 (Simpson, 2018; "fisheriesIreland.ie", n.d.). The degree to which small-eyed rays show residency and site fidelity is yet to be truly confirmed by further biologging studies. For example, a tagging study on small-eyed rays showed that after an average of 170 days at liberty, 90% travelled fewer than 30 km from the original tagging site, with only one individual showing a different behaviour by travelling a minimum straight-line distance of 83 km from the tagging site (Simpson, 2018). Although little is known about where this species lays its eggs, it is thought to lay eggs annually in sandy and muddy flats (Breder & Rosen 1966) with anecdotal evidence of egg cases being laid in Ballycotton and Youghal Bay (within our study site), which consist of rocky, sandy and muddy substrates (E. Farrell pers. comm. March 2024). These sessile egg cases will be vulnerable to disturbance on the seabed.

**The highest associated sensitivity scoring for the small-eyed ray was in relation to targeted (medium confidence) and non-targeted removal (bycatch) by fishing (high confidence).** Although there is management in place in terms of a TAC and there is a suggestion that the stock is no longer in decline, accurate stock estimates are lacking and bycatch and discard cannot be quantified (ICES, 2022). The effects of capture in fisheries are highly species-specific (see Cameron et al., 2023 and Horton et al., 2023 for a review of catch-and-release studies), however mortality and a reduction in post-release fitness occurs in most elasmobranch species. For example, female elasmobranchs are thought to withstand capture in nets due to a thicker subcutaneous layer (Enever et al., 2009). However, even though females outnumbered males in captures in a commercial tow fishery by 3:1, this species displayed the lowest post-release survival rate (51%) of four ray species (Enever et al., 2009). This suggests the small-eyed ray might be more sensitive to bycatch in fisheries than other ray species (Enever et al., 2009). Following a precautionary approach, the small-eyed ray was deemed sensitive to transition elements and organo-metal contamination (low confidence), hydrocarbon and PAH contamination (low confidence). A lack of literature documenting preferred habitat of this species (at all life stages), resulted in an assessment of NEv for abrasion/disturbance of substratum surface. However, this may change should additional studies be conducted on this species beyond localised coastal studies.

**The small-eyed ray was identified as not sensitive to the shipping-related pressure of underwater noise**. Lab-based studies suggest noise can increase swimming activity (de Vincenzi et al., 2021), whereas research in the wild indicates an unclear response to boat traffic (Rider et al., 2021). Hearing in demersal elasmobranch species seems to be most sensitive to low frequencies (Casper, 2006), however the impact of vessel sound on elasmobranch species is poorly understood. Contemporary research on shark species such as juvenile tope has shown that they respond to frequencies within the operational range of wind turbines and shipping (Tougaard et al., 2020; Nieder et al., 2023). However, how this will affect less mobile species or sessile egg cases is not understood.

**Offshore energy impacts on elasmobranchs are poorly understood, however, the small-eyed ray was deemed highly sensitive to physical loss of marine habitat (low confidence) and moderately sensitive to heavy smothering and siltation changes (low confidence).** Although there is little contemporary literature surrounding the reproductive biology of small-eyed rays, other than the effects of temperature on development (Koop, 2005; Hume, 2019), based on the historical literature and knowledge of other ray species, they were deemed moderately sensitive to the pressures of physical loss of marine habitat (low confidence) and heavy smothering and siltation changes (low confidence) owing to their sessile egg cases. Given the nursery areas for egg-laying have not been delineated in the Celtic Sea region, a precautionary approach is recommended. Construction activities may displace some elasmobranch species, although quantitative data are absent. Electromagnetic fields from high voltage cables are likely to affect the behaviour of some species (Gill et al., 2009; Hutchison et al., 2020). However, this has not been investigated for the small-eyed ray. It is possible that post construction, wind farms may provide refugia and artificial reef communities which could prove beneficial to some species of elasmobranch.

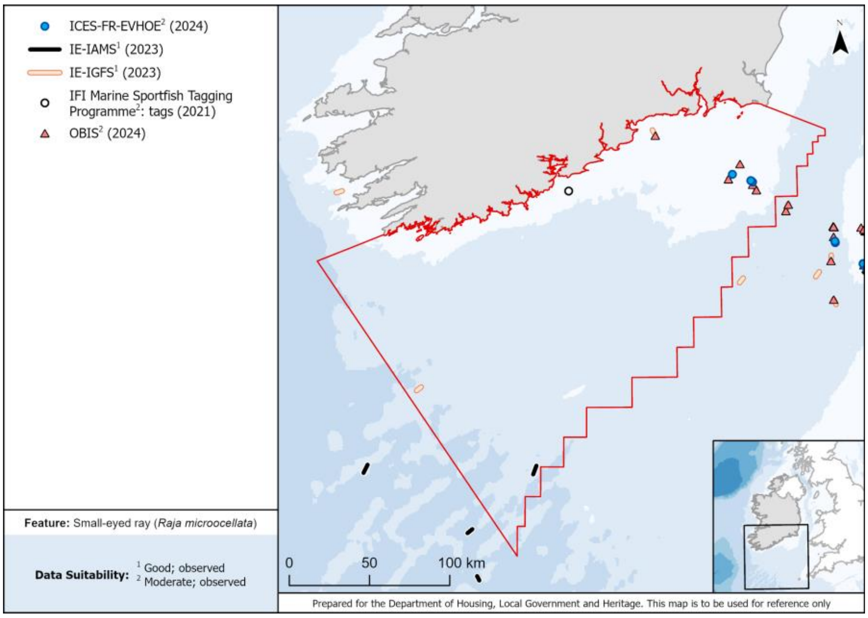


Figure A10.7.3. Data available for small-eyed ray (*Raja microocellata*) in the Celtic Sea.

Sensitivity assessment

**Data sources available**

Data sources for small-eyed ray in the Celtic Sea AOI that were available to the MPA Advisory Group, and the quality / suitability of those data for conservation prioritization analyses (See Table 3.2.1 Main Report), are shown in Figure A10.7.3. Data were not considered suitable for inclusion in prioritization analyses due to sparsity of records and lack of spatial coverage.

**Further research needs**

The small-eyed ray is poorly studied and its population or populations, appear to not be accurately quantified. Further work is required to identify population size, population trends, genetically unique populations, migrations and movements, essential habitats, spawning and nursery areas. In addition, evidence to identify the potential effect of multiple pressures was insufficient to form an assessment, or relied heavily on expert judgement, particularly as there is no generation length estimate or maximum age estimate for this species. These pressures included the effects of abrasion/disturbance of substratum surface or seabed, penetration or disturbance of substratum subsurface, changes in suspended solids (water clarity), water flow changes, smothering and siltation changes (light), electromagnetic energy, death or injury by collision, transition elements and organo-metal contamination, hydrocarbon and PAH contamination, synthetic compound contamination, deoxygenation, introduction of other substances and the introduction or spread of invasive non-indigenous species.

**References**

Breder, C.M., & Rosen, D.E. (1966). Modes of reproduction in fishes. T.F.H. Publications, Neptune City, New Jersey. 941 pp. ISBN 0876661207

Cameron, L.W.J., Roche, W.K., Beckett, K., & Payne, N.L. (2023). A review of elasmobranch catch-and-release science: synthesis of current knowledge, implications for best practice and future research directions. *Conservation Physiology,* 11, coad100. https://doi.org/10.1093/conphys/coad100

Casper, B. (2006). The hearing abilities of elasmobranch fishes. Unpublished PhD Thesis. 146 pp. University of South Florida, Tampa Graduate Theses and Dissertations. Available at: https://digitalcommons.usf.edu/etd/2476

de Vincenzi, G., Micarelli, P., Viola, S., Buffa, G., Sciacca, V., Maccarrone, V., Corrias, V., Reinero, F.R., Giacoma, C., & Filiciotto, F., (2021). Biological Sound vs. Anthropogenic Noise: Assessment of Behavioural Changes in *Scyliorhinus canicula* Exposed to Boats Noise. *Animals,* 11, 174. https://doi.org/10.3390/ani11010174

Ellis, J.R., Cruz-Martinez, A., Rackham, B.D., & Rogers, S.I. (2005a). The distribution of chondrichthyan fishes around the British Isles and implications for conservation. *Journal of Northwest Atlantic Fishery Science,* 35,195–213. https://doi.org/10.2960/J.v35.m485

Ellis, J.R., Dulvy, N.K., Jennings, S., Parker-Humphreys, M., & Rogers, S.I. (2005b). Assessing the status of demersal elasmobranchs in UK waters: A review. J*ournal of the Marine Biological Association of the United Kingdom,* 85, 1025–1047. https://doi.org/10.1017/S0025315405012099

Enever, R., Catchpole T.L., Ellis, J.R., & Grant, A. (2009). The survival of skates (Rajidae) caught by demersal trawlers fishing in UK waters. *Fisheries Research,* 97, 72-76. https://doi.org/10.1016/j.fishres.2009.01.001.

Fahy, E., & O'Reilly, R. (1990). Distribution patterns of rays (Rajidae, Batoidei) in Irish waters. *Irish Naturalists Journal,* 2, 316–320. http://www.jstor.org/stable/25539533

Gill, A., Huang, Y., Gloyne-Philips, I., Metcalfe, J., Quayle, V., Spencer, J., & Wearmouth, V. (2009). COWRIE 2.0 Electromagnetic Fields (EMF) Phase 2: EMF-sensitive fish response to EM emissions from sub-sea electricity cables of the type used by the offshore renewable energy industry. Commissioned by Cowrie Ltd (project reference COWRIE-EMF-1-06). 128 pp.

Gordon, C.A., Hood, A.R., & Ellis, J.R. (2016.) Descriptions and revised key to the eggcases of the skates (Rajiformes: Rajidae) and catsharks (Carcharhiniformes: Scyliorhinidae) of the British Isles. *Zootaxa*, 4150, 255-280. http://doi.org/10.11646/zootaxa.4150.3.2.

Horton, T.W., Exeter, O., Garzon, F., Gordon, C., Hawkes, L.A., Hood, A., Righton, D., Silva, J.F., & Witt, M.J. (2023). Best practices for catch-and-release shark angling: current scientific understanding and future research. *Fisheries Research,* 267, 106760. https://doi.org/10.1016/j.fishres.2023.106760

Hume, J.B. (2019). Higher temperatures increase developmental rate & reduce body size at hatching in the small-eyed skate *Raja microocellata*: implications for exploitation of an elasmobranch in warming seas. *Journal of Fish Biology,* 95, 655–658. https://doi.org/10.1111/jfb.13997

Hutchison, Z.L., Gill, A.B., Sigray, P., He, H., & King, J.W. (2020). Anthropogenic electromagnetic fields (EMF) influence the behaviour of bottom-dwelling marine species. *Scientific Reports*, 10, 4219. https://doi.org/10.1038/S41598-020-60793-X.

ICES (2022). Small-eyed ray (*Raja microocellata*) in divisions 7.f and 7.g (Bristol Channel, Celtic Sea North). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, rje.27.7fg. https://doi.org/10.17895/ices.advice.19754440

Koop, J. (2005). Reproduction of captive *Raja spp*. in the Dolfinarium Harderwijk. Journal of the *Marine Biological Association of the United Kingdom,* 85, 1201–1202. https://doi.org/10.1017/S0025315405012312.

La Blanchère, H. de (1868). La pêche et les poissons. Nouveau dictionnaire général des pêches, Paris, Delagrave, 859 p. https://doi.org/10.5962/bhl.title.6891

Lynam, C.P., Bluemel, J., & Probst, N. (2022). Recovery of Sensitive Fish Species. In OSPAR, 2023: The 2023 Quality Status Report for the Northeast Atlantic. OSPAR Commission, London. https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/indicator-assessments/recovery-sensitive-fish-species/

Nieder, C., Rapson, J., Montgomery, J.C., & Radford, C.A. (2023). Comparison of auditory evoked potential thresholds in three shark species. *Journal of Experimental Biology*, 226, jeb245973. https://doi.org/10.1242/jeb.245973

Rider, M.J., Kirsebom, O.S., Gallagher, A.J., Staaterman, E., Ault, J.S., Sasso, C.R., Jackson, T., Browder, J.A., & Hammerschlag, N., (2021). Space use patterns of sharks in relation to boat activity in an urbanized coastal waterway. *Marine Environmental Research,* 172, 105489. https://doi.org/10.1016/j.marenvres.2021.105489

Rousset, J. (1990). Catches and geographical distribution of selachians on the western coast of Brittany. *Journal of the Marine Biological Association of the United Kingdom,* 70, 255–260. https://doi.org/10.1017/S0025315400035372

Ryland, J.S., & Ajayi, T.O. (1984). Growth and population dynamics of three Raja species in Carmarthen Bay, British Isles. *Journal de Conseil Internationale de Exploration de la Mer,* 41, 111-120. https://doi.org/10.1093/icesjms/41.2.111

Simpson, S.J. (2018). Spatial ecology and fisheries interactions of Rajidae in the UK. Unpublished PhD Thesis: 241 pp. The University of Southampton, UK. Available at: http://eprints.soton.ac.uk/id/eprint/427037

Stehmann, M., & Burkel, D.L. (1984). Rajidae. In P.J.P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen & E. Tortonese (eds) Fishes of the North-eastern Atlantic and Mediterranean. Vol. 1. pp: 163–196. UNESCO, Paris.-51. https://doi.org/10.1016/j.marpol.2016.03.022

Tougaard, J., Hermannsen, L., & Madsen, P.T. (2020). How loud is the underwater noise from operating offshore wind turbines? *The Journal of the Acoustical Society of America*, 148, 2885–2893. https://doi.org/10.1121/10.0002453 www.Fishbase.se [WWW Document], n.d. URL https://fishbase.mnhn.fr/summary/5492#:~:text=Eyes%20conspicuously%20small%3B%20dorsal%20fins,upper%20surface%20greyish%2C%20olive%20to (accessed 10.04.24).

www.fisheriesireland.ie [WWW Document], n.d. URL https://www.fisheriesireland.ie/species/small-eyed-ray-raja-microocellata (accessed 10.04.24).