6. Cuckoo ray (*Leucoraja naevus*)

Irish name: *Roc na súl dabh*

Figure 1: Cuckoo ray *Leucoraja naevus* © Edward Farrell (IUCNredlist.org)

Background

Cuckoo rays are a small skate species in the Class Chondrichthyes. They are a demersal species that is most common on sandy sediments in inshore water and shallow shelf seas at 20-500 m (J. Ellis et al., 2007). It is considered an offshore species (Clarke et al., 2016), generally occurring in deeper water in comparison to thornback and spotted rays, and it is abundant in the Irish Sea with a preference for course sand and gravel substrates (J. Ellis et al., 2015; J. R. Ellis, Cruz-Martinez, et al., 2005). In the Irish Sea, cuckoo rays have a broad diet of benthic species with a high proportion of small teleost fish (J. R. Ellis et al., 1996). Spotted rays have a maximum length of approx. 72 cm (J. R. Ellis, Dulvy, et al., 2005; Stehmann & Bürkel, 1984), In the Irish Sea, the length and age at 50% maturity for males and females was reported as 56.9 and 56.2cm (total length) and 4.2 and 4.3 years, respectively (Gallagher et al., 2005). Maximum age is reported as 12 years (Du Buit, 1976). Females lay paired eggs in sandy or muddy substrates, laying 70-150 per individual annually (Breder & Rosen, 1966; Stehmann & Bürkel, 1984). Juvenile cuckoo ray have been observed to be abundant in the southern Irish Sea and St George's Channel and in the Celtic Sea (J. R. Ellis, Cruz-Martinez, et al., 2005). Cuckoo rays are distributed throughout the Northeast Atlantic, including the Celtic and Irish

Sea, and the Mediterranean Sea (J. Ellis et al., 2015) and exhibit high levels of site fidelity (Simpson et al., 2021; Walker, 1996).

Rationale for spatial protection in the western Irish Sea

Cuckoo rays were nominated for inclusion because it was listed as vulnerable on the Irish red list for cartilaginous species in 2016 due to a declining population trend (Clarke et al., 2016).

Spotted rays are currently managed under a generic total allowable catch (TAC) with other named ray species. This TAC includes thornback (*R. clavata*), painted (*R. microoecllata*), blonde (*R. brachyura*), spotted (*Raja montagui*) (Common Fisheries Policy, 2016). ICES considers that "Management of the catches of skates and rays under a combined TAC prevents effective control of single-stock exploitation rates and could lead to the overexploitation of some species." (ICES, 2022). Some misidentification of cuckoo ray in landings data is possible, but is unlikely to be significant and discarding is known to take place and cannot be quantified (ICES, 2022).

Based on current knowledge spotted rays are amenable to spatial protection. Cuckoo ray are recorded throughout the Irish Sea (Clarke et al., 2016; Dedman et al., 2017; ICES, 2022), and it is likely that the shallow sandy/muddy bays along the eastern coastline are important for egg laying and juvenile stages (Breder & Rosen, 1966; Stehmann & Bürkel, 1984). Tagging studies suggest that cuckoo rays tagged in the Irish Sea, generally stay within the Irish Sea, although movements of >100 km were common (Bird et al., 2020). This would suggest that cuckoo rays move more than some other demersal ray species (Simpson et al., 2021) and area protection should be designed around a skate/ray generic distribution.

Sensitivity assessment

The highest associated sensitivity scoring for cuckoo ray was in relation to its targeted and non-targeted removal (bycatch) by fishing (high confidence). The main threat to cuckoo rays is from fisheries (figure 2), primarily through the non-targeted removal of the species. Cuckoo rays are not considered commercially important and are generally by-caught in trawl and gillnet fisheries that target other more valuable species (ICES, 2022). Following a precautionary approach, cuckoo rays were deemed sensitive to transition elements and organo-metal contamination (low confidence), hydrocarbon and PAH contamination (low confidence). Cuckoo rays were deemed to have a medium sensitivity to heavy smothering and siltation changes which may result from bottom trawling activities (low confidence). While adults will likely move away from heavy siltation pressure, the sessile benthic eggs are vulnerable to becoming covered over and deprived of oxygenated fresh water.

Following a precautionary principle, cuckoo rays were assessed as sensitive to some shipping related pressures including contaminants (low confidence). There is no evidence that shipping activity directly impacts demersal rays, and the risk of collision was assessed as Not Relevant. Cuckoo rays were assessed as Not Sensitive to underwater noise (low confidence), however, the impacts of anthropogenic noise on elasmobranch species are very

poorly understood. Lab based studies suggest noise can increase swimming activity (de Vincenzi et al., 2021), whereas research in the wild indicates an equivocal response to boat traffic (Rider et al., 2021). Hearing ability in demersal species seems to be most sensitive to low frequencies from nearby sources (Casper, 2006) suggesting cuckoo ray may not be sensitive to vessel-related noise.

Offshore energy impacts on elasmobranchs are poorly understood, however, cuckoo rays were deemed moderately sensitive or sensitive to several offshore energy impacts. Physical loss of marine habitat, abrasion/disturbance of the seabed, and heavy smothering/siltation were assessed at a medium sensitivity (low confidence) owing to limited mobility of early life stages. Other ORE associated pressures were assessed as Low or Not sensitive (e.g., water flow changes), however, the quality, applicability and concordance of the available evidence is low and, in some instances, non-existent. For instance, cuckoo ray are electrosensitive and can detect weak electromagnetic fields (EMF) (Gill & Taylor, 2001). Other similar species are affected by electromagnetic fields from high voltage cables (Gill et al., 2009; Hutchison et al., 2020), therefore, some impact on cuckoo ray is possible. The cumulative long-term impacts of large offshore energy developments are unknown currently. Post construction, wind farms may provide refugia and artificial reef communities which could prove beneficial to some species of elasmobranch. Construction activities may displace some species; however, quantitative data is absent.

Further research needs.

Further work is required to identify population size, population trends, migrations and movements, essential habitats, spawning and nursery areas. Equally, discard quantity and survival require further investigation. In addition, evidence to identify the potential effect of multiple pressures was insufficient to form an assessment, or relieved heavily on expert judgment. These pressures included the effects of changes in suspended solids (water clarity), smothering and siltation changes (light and medium), electromagnetic energy, death or injury by collision, transition elements and organo-metal contamination, hydrocarbon and PAH contamination, synthetic compound contamination, introduction of other substances and the introduction or spread of invasive non-indigenous species.

Figure 2. Geographic distribution in the northeast Atlantic (https://www.iucnredlist.org/species/161626/48949434#geographic-range)

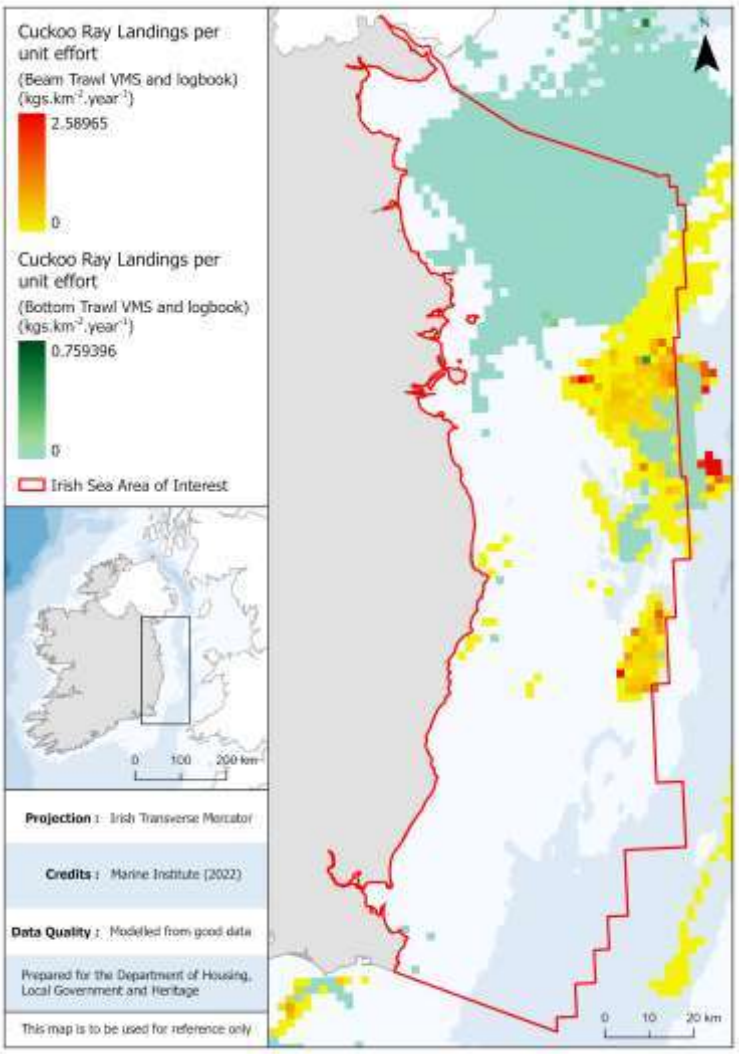

Figure 3. Distribution of cuckoo ray (*Leucoraja naevus*) in the western Irish Sea. Data from ICES international fishing effort and swept area ratios and VMS.

Data sources and quality

Dataset Name	Data Owning Organisation	Dataset Quality	Metadata URL	Comments
Dedman *et al.* (2015) Species Distribution Model (SDM)	Dedman *et al* (2015)	Modelled from moderate data		
ICES international fishing effort and swept area ratios; VMS	International Council for the Exploration of the Seas	Modelled from good data		
International Bottom Trawl Survey (IBTS) Fisheries Database of Trawl Surveys (DATRAS)	International Council for the Exploration of the Seas	Good; observed	IE-IGFS and NIGFS	Data is sparse for this species

Marine Institute VMS and logbook	Supplied to Marine Institute by Irish Naval Service and Sea Fisheries Protection Authority	Modelled from good data		

References

Bird, C., Burt, G. J., Hampton, N., Phillips, S. R. M., & Ellis, J. R. (2020). Fifty years of tagging skates (Rajidae): Using mark-recapture data to evaluate stock units. *Journal of the Marine Biological Association of the United Kingdom*, *100*(1), 121–131. https://doi.org/10.1017/S0025315419000997

Breder, C. M., & Rosen, D. E. (1966). *Modes of reproduction in fishes*.

Casper, B. (2006). *The hearing abilities of elasmobranch fishes* [University of South Florida]. https://digitalcommons.usf.edu/etd/2476

Clarke, M., Farrell, E. D., Roche, W., Murray, T. E., Foster, S., Marnell, F., & Nelson, B. (2016). *Ireland Red List No. 11: Cartilaginous fish (sharks, skates, rays and chimaeras)*. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

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*(1), Article 1. https://doi.org/10.3390/ani11010174

Dedman, S., Officer, R., Brophy, D., Clarke, M., & Reid, D. G. (2017). Advanced spatial modeling to inform management of data-poor juvenile and adult female rays. *Fishes*, *2*(3), 12.

Du Buit, M. H. (1976). The ovarian cycle of the cuckoo ray, Raja naevus (Müller and Henle), in the Celtic Sea. *Journal of Fish Biology*, *8*(3), 199–207.

Ellis, J., Dulvy, N., & Walls, R. (2015). *Leucoraja naevus. The IUCN Red List of Threatened Species 2015: E. T161626A48949434*.

Ellis, J. R., Cruz-Martinez, A., Rackham, B. D., & Rogers, S. I. (2005). 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. (2005). Assessing the status of demersal elasmobranchs in uk waters: A review. *Journal of the Marine Biological Association of the United Kingdom*, *85*(5), 1025–1047. https://doi.org/10.1017/S0025315405012099

Ellis, J. R., Pawson, M. G., & Shackley, S. E. (1996). The comparative feeding ecology of six species of shark and four species of ray (Elasmobranchii) in the north-east Atlantic. *Journal of the Marine Biological Association of the United Kingdom*, *76*(1), 89–106.

Ellis, J., Ungaro, N., Serena, F., Dulvy, N., Tinti, F., Bertozzi, M., Pasolini, P., Mancusi, C., & Noarbartolo di Sciara, G. (2007). *Raja montagui. The IUCN Red List of Threatened Species 2007: E. T63146A12623141*.

Gallagher, M. J., Nolan, C. P., & Jeal, F. (2005). Age, growth and maturity of the commercial ray species from the Irish Sea. *Journal of Northwest Atlantic Fishery Science*, *35*, 47–66.

Gill, A. B., & Taylor, H. (2001). *The potential effects of electromagnetic fields generated by cabling between offshore wind turbines upon elasmobranch fishes* (Vol. 33, Issue 10). Countryside Council for Wales Bangor (UK.

ICES. (2022). *Cuckoo ray (Leucoraja naevus) in subareas 6 and 7, and in divisions 8.a–b and 8.d (West of Scotland, southern Celtic Seas, and western English Channel, Bay of Biscay)* [Report]. ICES Advice: Recurrent Advice. https://doi.org/10.17895/ices.advice.19754470.v1

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

Simpson, S. J., Humphries, N. E., & Sims, D. W. (2021). Habitat selection, fine-scale spatial partitioning and sexual segregation in Rajidae, determined using passive acoustic telemetry. *Marine Ecology Progress Series*, *666*, 115–134. https://doi.org/10.3354/meps13701

Stehmann, M. F. W., & Bürkel, D. L. (1984). Rajidae. In P. J. Whitehead, M. L. Bauchot, J. C. Hureau, & E. Tortonese (Eds.), *Fishes of the North-Eastern Atlantic and the Mediterranean*. UNESCO.

Walker, P. (1996). Long-term changes in ray populations in the North Sea. *ICES Journal of Marine Science*, *53*(6), 1085–1093. https://doi.org/10.1006/jmsc.1996.0135