Received: 27 August 2024 | Accepted: 17 February 2025

DOI: 10.1002/pan3.70044

People and Nature

RESEARCH ARTICLE

A fisher's perspective: Using half a century of local fisher knowledge to identify socio-economic, ecological and legislative trends influencing angelshark (*Squatina squatina*) records in Wales

Francesca C. Mason[1,2,3] | Jake Davies[1,4] | Surshti Patel[1] | Ben Wray[4] | Charlie Bartlett[5] | Michael Davies[5] | Rowland Sharp[4,5] | Carl Worrall[5] | Jim Evans[6] | John O'Connor[7] | Sarah Davies[1,4] | Alice Chamberlain[1] | Charlotte Pike[1] | Kathryn E. Whittey[1] | Claire Collins[3,8] | Matthew Gollock[1] | Joanna Barker[1] | David J. Curnick[3,9]

[1]Zoological Society of London, London, UK; [2]School of Biosciences, Cardiff University, Cardiff, UK; [3]Institute of Zoology, Zoological Society of London, London, UK; [4]Natural Resources Wales, Bangor, UK; [5]Fisher, Gwynedd, UK; [6]Welsh Fishermen's Association, Ceredigion, UK; [7]Angling Cymru Sea Anglers, Pembrokeshire, UK; [8]Centre for Ecology and Conservation, College of Life and Environmental Sciences, University of Exeter, Penryn, UK and [9]Department of Genetics, Evolution & Environment, University College London, London, UK

Correspondence
Jake Davies
Email: jake.davies@zsl.org

Francesca C. Mason
Email: masonfc@cardiff.ac.uk

Funding information
National Lottery Heritage Fund, Grant/Award Number: NM-21-00082 and OH-17-04951; Nature Networks Fund (Welsh Government), Grant/Award Number: NL-21-00088 and NL-22-00100; On the Edge, Grant/Award Number: No.1163124; Research England

Handling Editor: Andrea Belgrano

Francesca C. Mason and Jake Davies are joint first authors. Joanna Barker and David J. Curnick are joint last authors.

Received: 27 August 2024 | Accepted: 17 February 2025

DOI: 10.1002/pan3.70044

People and Nature

RESEARCH ARTICLE

A fisher's perspective: Using half a century of local fisher knowledge to identify socio-economic, ecological and legislative trends influencing angelshark (*Squatina squatina*) records in Wales

Francesca C. Mason[1,2,3] | Jake Davies[1,4] | Surshti Patel[1] | Ben Wray[4] | Charlie Bartlett[5] | Michael Davies[5] | Rowland Sharp[4,5] | Carl Worrall[5] | Jim Evans[6] | John O'Connor[7] | Sarah Davies[1,4] | Alice Chamberlain[1] | Charlotte Pike[1] | Kathryn E. Whittey[1] | Claire Collins[3,8] | Matthew Gollock[1] | Joanna Barker[1] | David J. Curnick[3,9]

[1]Zoological Society of London, London, UK; [2]School of Biosciences, Cardiff University, Cardiff, UK; [3]Institute of Zoology, Zoological Society of London, London, UK; [4]Natural Resources Wales, Bangor, UK; [5]Fisher, Gwynedd, UK; [6]Welsh Fishermen's Association, Ceredigion, UK; [7]Angling Cymru Sea Anglers, Pembrokeshire, UK; [8]Centre for Ecology and Conservation, College of Life and Environmental Sciences, University of Exeter, Penryn, UK and [9]Department of Genetics, Evolution & Environment, University College London, London, UK

Correspondence
Jake Davies
Email: jake.davies@zsl.org

Francesca C. Mason
Email: masonfc@cardiff.ac.uk

Funding information
National Lottery Heritage Fund, Grant/Award Number: NM-21-00082 and OH-17-04951; Nature Networks Fund (Welsh Government), Grant/Award Number: NL-21-00088 and NL-22-00100; On the Edge, Grant/Award Number: No.1163124; Research England

Handling Editor: Andrea Belgrano

Abstract

1. The evolution of marine fisheries has broadly influenced the ecology, distribution and abundance of coastal elasmobranchs. However, quantifying these interactions remains a challenge due to the scarcity of historical records.
2. Fishers' local ecological knowledge (LEK) is an essential tool in fisheries research, providing an avenue to regain scarce information on rare or cryptic species and contextualise modern observations and trends.
3. LEK was collected from 27 semi-structured interviews with commercial, recreational and charter fishers to better understand the ecology and temporal population trends for the Critically Endangered angelshark (*Squatina squatina*) within Wales, United Kingdom. Questions were designed to identify fisher perceptions of socio-economic, ecological and legislative factors that drove changes in fishing effort for vessels operating within the 'Welsh Zone' between 1968 and 2019.
4. Understanding how fleet-wide spatiotemporal changes to fishing effort and capacity within commercial, recreational and charter fisheries have influenced historical records and sightings of *S. squatina* is an important consideration for assessing its status in Wales and designing appropriate actions to safeguard the species.

Francesca C. Mason and Jake Davies are joint first authors. Joanna Barker and David J. Curnick are joint last authors.

5. Our findings identify structural changes to fisheries in Wales and key driving factors that likely decreased fishers' likelihood of encountering *S. squatina* over a 51-year period. Therefore, we suggest recent published estimates of population declines may be overstated.
6. Furthermore, we highlight the importance of quantifying and incorporating changes in fishing effort at a regional scale into future modelling approaches for elasmobranchs and advocate for the increased consideration of LEK in the development of management strategies.

KEYWORDS
fisher knowledge, fisheries, fisheries changes, historical records, local ecological knowledge, *Squatina squatina*, Wales

1 | INTRODUCTION

Globally, industrial fishing in nearshore regions has resulted in widespread declines for many important fish stocks, contributing to functional changes in community structure (Jackson et al., 2001; Myers & Worm, 2003). Yet, determining the effect of historical sea fishing (herein 'fisheries' and 'sea fishing' refers to all marine sectors (commercial, recreational and charter boat) unless specified) on species distribution and abundance presents a formidable challenge, given ecological records documenting these interactions rarely extend beyond the preceding decades (Pinnegar & Engelhard, 2008; Thurstan, 2022; Engelhard et al., 2016). For non-commercially targeted species and those that rarely overlap spatially with fisheries, deciphering historical population trends is especially difficult as these species are often absent or deficient in available fisheries-derived data sets; therefore, our ability to characterise spatiotemporal changes to populations is limited (Ovando et al., 2022; Pinto et al., 2019; Rufener et al., 2021). Considering this, alternative approaches and fisheries-independent datasets should be utilised alongside landing data to enhance the monitoring of data-deficient stocks (Hilborn & Walters, 2013; Mesnil et al., 2009; Robinson & Frid, 2008).

The incorporation of historical marine ecology (HME) (e.g. palaeoecological, archaeological and historical records), particularly the integration of local ecological knowledge (LEK) and/or fisher knowledge (FK) has provided a much-needed avenue to understand the past state of marine environments and historical changes to fish populations (Kittinger et al., 2015; Thurstan et al., 2015). Standardised social science methodologies provide a systematic process to obtain important species-specific information from commercial, recreational and charter fishers (herein referred together as 'fisher(s)' unless specified) on the distribution, abundance and behaviour of data-poor fish populations, enabling researchers to address crucial knowledge gaps that cannot be addressed through empirical approaches alone (Pantin et al., 2015; Silvano & Valbo-Jørgensen, 2008). Integrated methodologies that combine LEK with quantitative fisheries data, alternative survey methodologies (e.g. eDNA, satellite imagery) and statistical modelling (e.g. LEK-derived catch-per-unit-effort (CPUE)) can yield more robust historical baselines and abundance estimations (Dunn et al., 2025; Early-Capistrán et al., 2020; Exeter et al., 2021). Despite the evident advantages of incorporating HME for understanding and managing fisheries, there remains a critical need for broader implementation of these integrated approaches in marine conservation and policymaking particularly in data-poor regions.

Fishing is an important industry and recreational activity for coastal communities in Wales, United Kingdom, for generations, with many regions today (e.g. Milford Haven and Holyhead) still heavily reliant on aquatic resources to support livelihoods, local economies and well-being (Monkman et al., 2015; Moore et al., 2024; Peirson et al., 2001) (Figure 1). Historically, commercial sea fishing, specifically bottom trawling, is believed to date back to at least the 14th century in England, before later expansion of the industry to Wales occurred in the 17th–19th centuries (Jones, 2018; Thurstan et al., 2010). The late 19th century witnessed the most rapid increase in Welsh fishing capacity, driven by the development of industrial-scale fishing and fleet modernisation (e.g. steam-powered vessels) (Knauss, 2004; Thurstan et al., 2010). This likely resulted in significant, yet potentially undocumented, impacts on fish stocks due to increased demand for marine resources and improved access to fishing grounds (Hernvann & Gascuel, 2020; Thurstan et al., 2010). Presently, most of the Welsh commercial fishing fleet is comprised of smaller polyvalent vessels (<10 m) fishing close to home ports, with larger vessels commonly based out of Milford Haven, Holyhead and Saundersfoot (Marine Management Organisation, 2021). Over the past half-century, the nature and scale of commercial fisheries operating within the UK Exclusive Economic Zone (EEZ) has changed considerably, primarily due to the gradual introduction of legislation and policies like the Common Fisheries Policy in 1983 and its subsequent reforms (EU Commission, 2013). These measures introduced quotas, licencing systems, and stricter regulations on marine resource extraction in response to stock depletions, resulting in significant impacts on fishing capacity (Daw & Gray, 2005; Hatcher & Read, 2001a, 2001b). For example, from 1991 to 2021, there has been a 49% decline in the number of active UK-registered commercial fishing vessels within the UK EEZ

FIGURE 1 Historical photos depicting fishing in Wales. (a) The Dog and Partridge Angling Club from Eccles, Manchester with a catch of 87 Thornback Ray in 1983 (Photography by Vic Haigh). (b) Unknown fisherman unloading catch (year unknown). (c) The Endeavour Charter Boats leaving port in Aberystwyth. (d) Hollington Club Members on Endeavour Charter Boat out of Aberystwyth. Pictures provided by the Peoples Collection of Wales licenced under Creative Archive Licence.

(Marine Management Organisation, 2021; Uberoi et al., 2021). There has also been a documented decline in the number of charter boat operators in Wales, from at least 72 boats operating in 1973 to 40 in 2019 (Barker et al., 2022). While references to fishing activities date back to the 17th century, as evidenced by George Owen of Henllys' 'Description of Penbrokshire' (1603) and Izaak Walton's (2014) 'The Compleat Angler' (1653), the origins of charter fisheries remain poorly understood (Winfield, 2016). Furthermore, trends in recreational charter fishing effort and catches over the past half-century have not been comprehensively assessed in Wales due to a scarcity of data (APBmer Ltd., 2020; Goudge & Morris, 2011; Monkman et al., 2015).

Sharks, skates and rays (subclass: Elasmobranchii herein 'elasmobranchs') are vital components of marine ecosystems, often exhibiting slow life history strategies (e.g. slow growth, low fecundity and late maturity) and behavioural adaptations (e.g. long migrations, aggregation, philopatry) that make them vulnerable to overexploitation and habitat loss (Dulvy et al., 2021; Stevens et al., 2000). Traditionally, understanding elasmobranch abundance trends has been heavily dependent on historical catch records from mixed commercial fisheries (Fowler et al., 2004; Ellis, Cruz-Martinez, et al., 2005; Ellis, Dulvy, et al., 2005; Hareide et al., 2007). However, prior to the mid-late 1990s and the start of fishery-independent monitoring, there was no requirement for commercial fisheries in the United Kingdom to record elasmobranch catches (Ellis, Cruz-Martinez, et al., 2005; Ellis, Dulvy, et al., 2005; FAO, 2000; Fowler et al., 2004). Elasmobranchs were often recorded and grouped as 'miscellaneous' or as generic categories (i.e. 'skates and rays') in mixed fisheries, resulting in insufficient and non-species-specific landing data (Lawson et al., 2020; Martin et al., 2010). In addition, fishery-dependent datasets can often be considered biased due to non-standardised factors (e.g. changing gear type and methods) and spatiotemporal changes in fishing locations that are often not accounted for or recorded (Simpfendorfer et al., 2002). Understanding these nuances in fishing effort and catch trends is important to ensure the long-term sustainability of fisheries resources and associated livelihoods.

The Celtic Sea Ecoregion, including the Welsh coastline, is an important area for the angelshark, *Squatina squatina*—an elasmobranch species listed as Critically Endangered on the IUCN Red List of Threatened Species—whose geographic range historically extended from the southwest coast of Norway (62° N) to northwest Africa (21° N) (Barker et al., 2022; Morey et al., 2019). Found in coastal waters and on continental shelves up to 200 m depth, *S. squatina* occupies a wide range of benthic habitats including reef, mud, sand and gravel (Ellis et al., 2021; Meyers et al., 2017). In recent years, there has been considerable effort to better understand the ecology, habitat preference, abundance and distribution of *S. squatina* (Barker et al., 2022; Jiménez-Alvarado et al., 2020; Moore & Hiddink, 2022). Yet, due to a lack of baseline information for *S. squatina* populations within the Celtic Sea Ecoregion, current understanding of the species is primarily based on populations from the Canary Islands and the Mediterranean (Ellis et al., 2021; Meyers et al., 2017). Records from the 19th and 20th centuries identify historical commercial fisheries for this species existing in Spain, France, Italy and Croatia (Fortibuoni et al., 2016; Lawson et al., 2020), yet there is no documented evidence of a commercial fishery targeting *S. squatina* in Wales; thus, alternative approaches are required.

As a bottom-dwelling coastal species, *S. squatina* are particularly susceptible to incidental capture by commercial fisheries that

interact with the seabed, especially those operating large mesh nets or bottom trawls; recreational fisheries due to spatial overlap (Ellis et al., 2021; Lawson et al., 2020); and habitat degradation due to proximity to anthropogenic activities along coastlines (Barker et al., 2020; Gordon et al., 2019). These threats have resulted in reported declines in *S. squatina* populations across their geographic range (Hiddink et al., 2019; Rogers & Ellis, 2000). Notably, a recent study by Hiddink et al. (2019) utilised LEK quantitative data on *S. squatina* catches collated from interviews and opportunistic records (e.g. charter skipper logbooks and online databases) to infer population abundance trends for the species across Wales, on the assumption that fishing effort had stayed constant. The study estimated that abundance had declined by 70% between 1970 and 2016, yet did not explore how wider socio-economic fishing practices have evolved in Wales over the past century and how these may have influenced the degree and nature of fishing effort and historical sightings and records of *S. squatina* (Hiddink et al., 2019).

As a prohibited species under the UK Wildlife and Countryside Act (1981), with further protection in Wales under the Section 6 Biodiversity and Resilience of Ecosystems duty, Environment (Wales) Act (2016), concerted efforts to safeguard this species in Wales led to the development of Angel Shark Project: Wales and the Wales Angelshark Action Plan ('Action Plan') (Barker et al., 2020). Led by the Zoological Society of London and Natural Resources Wales, the Action Plan was co-developed with a network of NGOs, Government Agencies, fishers and universities to address critical knowledge gaps for this species (Barker et al., 2020).

Here, we used interviews with fishers operating along the Welsh coast to identify potential socio-economic, ecological and legislative drivers of spatiotemporal changes in fishing effort in the Welsh Zone. We then used the collated LEK to investigate how these explanatory factors might have influenced historical records and sightings of *S. squatina* in Wales.

2 | METHODS

2.1 | Geographical scope

For this study, data collection targeted individuals fishing within the 'Welsh Zone' (ICES Divisions VII a, e–h) (Figure 2). In 2006, the implementation of the Government of Wales Act and the amendment to

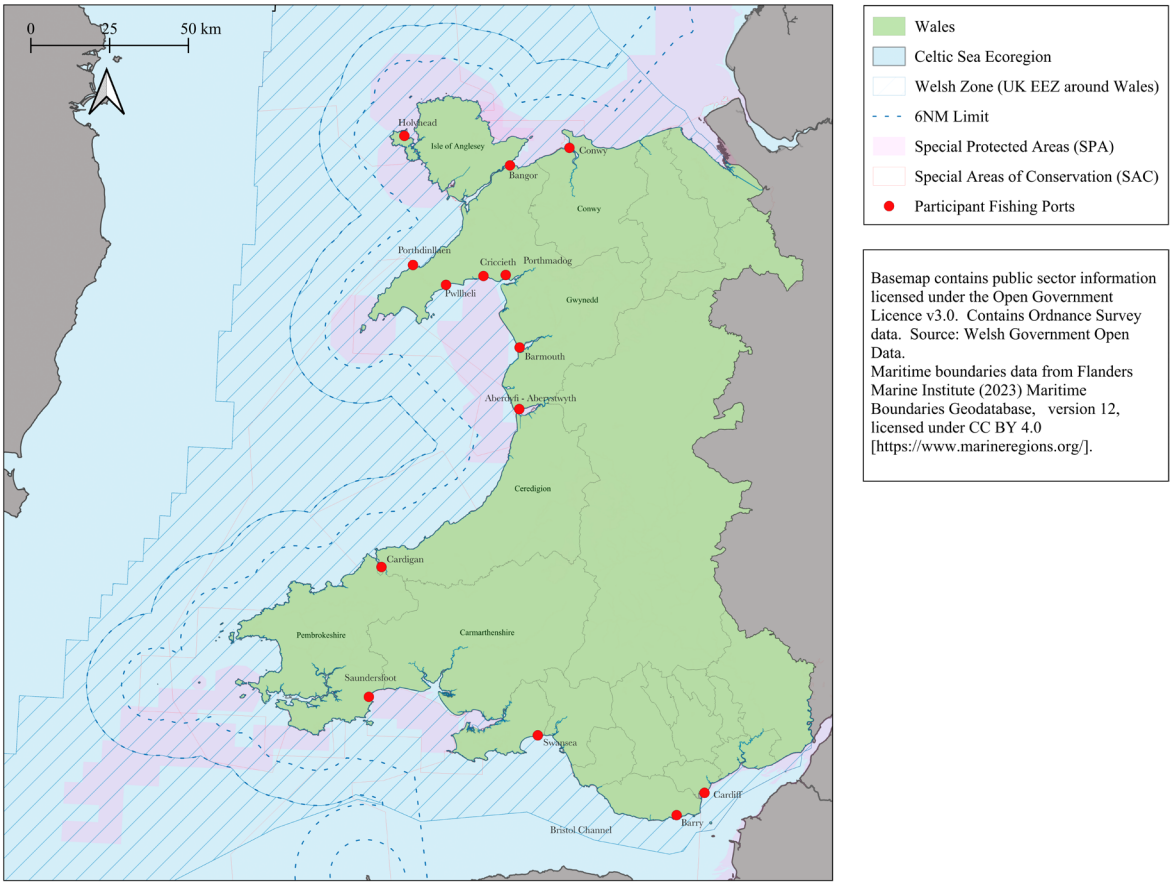

FIGURE 2 Geographical scope of this study. Boundaries for the UK EEZ around Wales (blue hashed area), six-mile limit (blue dashed line) and 12 mile limit the 'Welsh Zone' (blue line). Map indicates a 'general' location where fishers were based between 1969 and 2019 (red points). Fishers indicated that fishing locations and home ports changed over the years, therefore it was not always possible to allocate a fisher to a single home port (i.e. some fishers operated out of Aberdyfi and Aberystwyth). In addition, some fishers only provided information on general fishing location i.e. Cardigan Bay. Red points reflect available data.

the Marine and Coastal Access Act in 2009, allowed for the devolution and separation of fisheries in England and Wales and the creation of a 'Welsh Zone' within the UK EEZ (Government of Wales Act, 2006; Marine and Coastal Access Act, 2009; Williams et al., 2020). The majority of participants in this study ($n = 21$) were based out of harbours in North and West Wales including Aberdyfi, Barmouth and Porthmadog, and predominantly fish along the coast of the Llŷn Peninsula and within Cardigan Bay. Of the remaining participants, three fished the Bristol Channel, two in Swansea Bay and one in Carmarthen Bay.

2.2 | Data collection

This study was co-designed in collaboration with Angling Cymru Sea Anglers and the Welsh Fishermen's Association. As representatives of fishers in Wales, both organisations were involved with the project at the development stage and were involved throughout delivery through supporting methodological design, sharing contacts, providing iterative feedback and co-developing next steps.

2.2.1 | Participatory interviews

Participants all fished between 1968 and 2019 within the Welsh Zone, including inshore waters (0–12 nm) and offshore waters (12–200 nm). We categorised fishers into three distinct groups: commercial (primarily engaged in landing fish for commercial sale), charter (skippers and/or charter crew that operate vessels hired by groups or individuals for fishing trips for recreational purposes) and recreational (fishing for personal enjoyment or leisure only).

Our methodology used semi-structured interviews consisting of five prompts designed to collect data on: (a) *S. squatina* sightings and historical catch records, (b) *S. squatina* ecology and distribution, (c) fisher background (fisher category, location, active fishing years), (d) information on other elasmobranch catches and (e) observed changes in the fishing industry over time (fishing areas, gear type, changes in gear type and target species) (Supporting Information S1). To aid recall, personal timelines and participatory mapping exercises were carried out concurrently to provide a contextual timeframe and support the interview process (Connelly et al., 2000; Mundia, 2016). Fishers were presented with timelines that included key historical events that had been identified during previous informal interactions with fishers, such as significant national or fisheries-related events (e.g. Sea Empress oil spill in 1996) (Supporting Information S2). Nautical maps were provided to allow visualisation of spatiotemporal fishing effort and to identify areas where *S. squatina* were encountered (Supporting Information S3), although only nine fishers out of 27 provided spatial fishing data, due to the confidential nature of personal fishing locations. In addition, focused grey literature was collated for documents and reports explaining fishing changes in Wales (e.g. official fisheries statistics collected by the Ministry of Agriculture, Fisheries and Food (MAFF), Marine Management Organisation (MMO) Reports). This included a review of fisheries policy and legislation (documents compiled from MMO, MAFF, European Commission) (Figure 3).

2.2.2 | Confirmation processes

All interviews were transcribed from notes taken during the in-person interviews and later verified by the interviewee. Furthermore, subsequent meetings were organised for respondents to read and verify the interview transcripts to ensure they fairly represented their testimony and wider views. All respondents were invited to co-author the paper, provide either verbal or written feedback and input in the final draft. Free prior informed consent (FPIC) processes were undertaken for all participants. Validity checks and bias considerations were consistently addressed throughout the design and process of this study and authors involved in data collection and analysis have provided individual positionality statements (Supporting Information S4) (Holmes, 2020; Maxwell, 2012). All methods were approved by the Zoological Society of London's human ethics committee (ZSLHEC-001).

2.3 | Data analysis

Data collected from fisher interview notes were compiled, transcribed and verified before coding within NVivo software using thematic analysis (NVivo, 2020). An inductive six-step framework approach was used, as described by Braun and Clarke (2006), consisting firstly of data familiarisation, before identifying initial data-driven themes without the use of prior theoretical assumptions, allowing for underlying meanings to emerge from the data organically (Braun & Clarke, 2006; Kiger & Varpio, 2020). Once initial codes were generated, overarching themes and recurring patterns in the data were investigated before refinement and hierarchical arrangement into final themes (herein referred to as 'drivers') (Braun & Clarke, 2006; Newing et al., 2011). Through this thematic analysis, we identified important socio-economic, ecological and legislative explanatory factors perceived by fishers, that resulted in changes to the fishing landscape around Wales. Results were used to determine whether these changes could have increased or decreased the likelihood of fishers to interact with *S. squatina*.

3 | RESULTS

3.1 | Participants and vessel size

Overall, 27 participants were interviewed, comprising of 10 commercial fishers, eight charter skippers or crew on charter boats, five recreational anglers, while three participants worked on both commercial and charter boats and one individual had experience working as crew on a charter boat, but mainly fishes recreationally (Table 1). Participants had been actively fishing for between one and 51 years, with a mean of 26 years, spanning from 1968 to 2019. Eleven participants are still

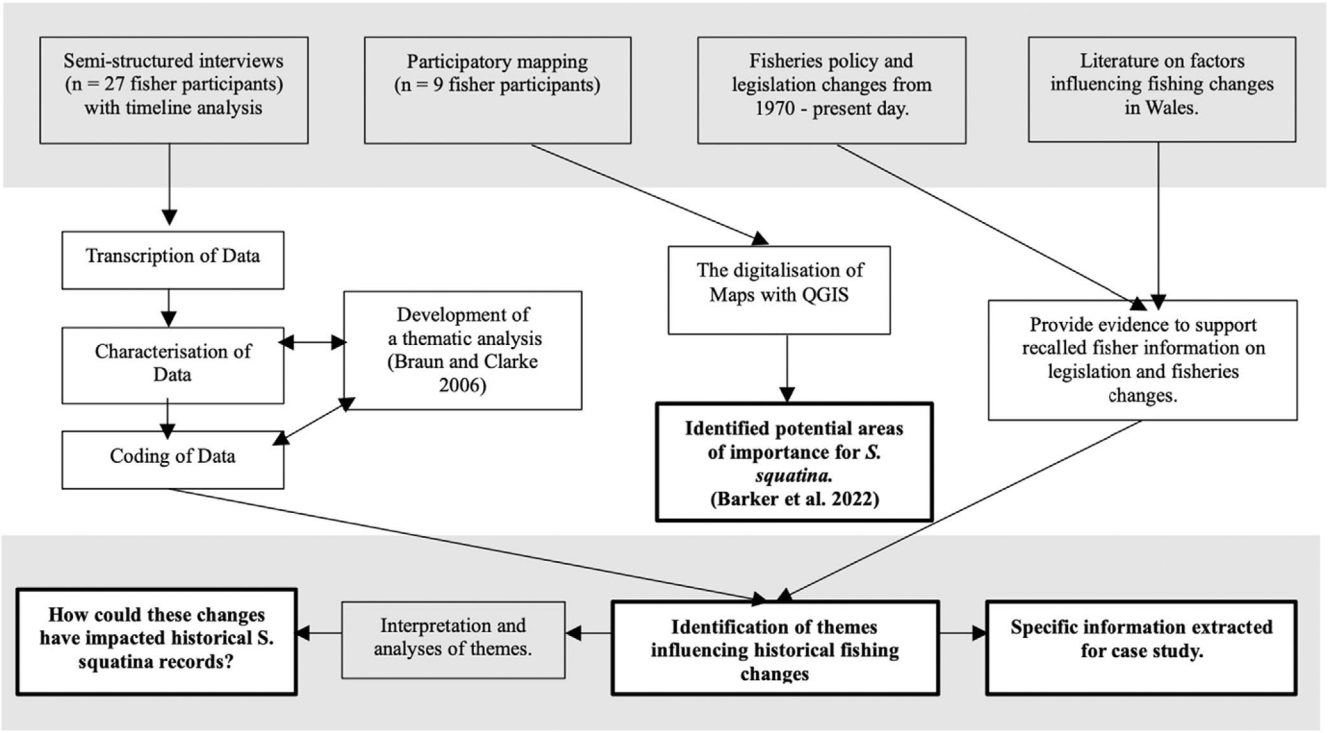

FIGURE 3 Schematic workflow diagram outlining the methodological approach used to collate and extract qualitative data on historical changes to the changing fishing landscape in Wales from 27 semi-structured interviews with commercial, charter and recreational fishers.

actively fishing in the Welsh Zone, with 48% ($n=13$) of participants employed full-time by the fisheries sector, mainly those currently employed or previously employed on commercial vessels. Many participants had complex work histories and were employed in different fishing sectors and vessels over time (part-time or full-time). Three fishers alternated between working on commercial vessels during the winter months and on charter boats during the summer months. Of the charter fishers interviewed, most operated and employed seasonal crew during the charter summer season, which runs from April to October. In contrast, shore and boat-based recreational anglers often fished all year round, although fishing effort (number of days fished) was often heavily dependent on weather and fisher availability (i.e. weekends, after-work excursions) (Table 1).

The majority of fishers interviewed 82% ($n=22$) worked on fishing vessels less than 10 m in length. However, many commercial fishers emphasised how vessel size has changed over the past several decades with the modernisation of the Welsh commercial fishing fleet, reflecting changes in target species, governance and the implementation of quota and non-quota species by the EU Common Fisheries Policy. Out of the 10 commercial fishers, 90% worked on polyvalent fishing vessels operating multiple gear types that varied seasonally and annually dependent on target species. Tangle nets or other static nets (e.g. gillnet), together referred to as 'netting', were used historically by all respondents working on commercial vessels, with 80% using pots and traps, 40% trawling, 20% deploying longlines and 10% dredging. Of the three fishers who combined commercial and charter boat fishing, all fished using rod and line while also operating additional gear types; one fisher used to tangle net for thornback rays, *Raja clavata*, one potted for crustaceans and one used to work on a trawler. Out of the charter boat and recreational fishers interviewed ($n=17$), the majority (94%) fished using a rod and line, except for one recreational fisher who spearfished (Figure 4).

3.2 | Angelshark, *Squatina squatina*

The following names, 'monkfish', 'monks', 'big uglies' and 'fiddler fish' were used to refer to *S. squatina* by fishers. All fishers interviewed recalled catching *S. squatina* before 2000, while 19% ($n=5$) discussed sightings post 2000. Additionally, 74% ($n=20$) of fishers noted that *S. squatina* was often caught incidentally by those targeting *R. clavata*. *S. squatina* were reported to be caught by the following gear types: tangle nets, rod and line, demersal trawls and gillnetting. A commercial/charter fisher used to refer to *S. squatina* catches as a '*nuisance*' due to the species' lack of commercial value and the implication that they would often '*mess up*' fishing gear. Furthermore, 56% ($n=15$) of fishers recalled that *S. squatina* were mainly sighted or caught between April and November, coinciding with the charter fishing season.

3.3 | Social and economic drivers

Fishers identified six potential overarching social and economic drivers that resulted in spatiotemporal changes to fishing effort

TABLE 1 Vessel attributes and respondent characteristics for all fishers interviewed in this study.

	Fisher backgrounds			Vessel characteristics		
Participant categories	**Active fishing years**	**Mean (± SD) years fished**	**Employment status**	**Vessel size**	**Season fished**	**Fishing location**
Total ($n=27$)	1968–2019	26 (±16)	Active: 11 Retired: 16	82% ($n=22$) <10 m Vessel 7% ($n=2$) <24 m Vessel 11% ($n=3$) Unknown	48% ($n=13$) All Year 33% ($n=9$) April–Oct 11% ($n=3$) Summer 4% ($n=1$) Autumn 4% ($n=1$) April–Nov	56% ($n=15$) Cardigan Bay 11% ($n=3$) Caernarfon Bay 11% ($n=3$) Bristol Channel 7% ($n=2$) Swansea Bay 7% ($n=2$) Tremadog Bay 4% ($n=1$) Carmarthen Bay 4% ($n=1$) Constable Bank
Commercial ($n=10$)	1977–2019	23 (±15.4)	Active: 5 Retired: 5	<10 m Vessel ($n=9$) <24 m Vessel ($n=1$)	All Year ($n=9$) Summer ($n=1$)	Cardigan Bay ($n=4$) Caernarfon Bay ($n=2$) Tremadog Bay ($n=2$) Carmarthen Bay ($n=1$) Constable Bank ($n=1$)
Charter ($n=8$)	1968–2019	25 (±19.1)	Active: 3 Retired: 5	<10 m Vessel ($n=7$) <24 m Vessel ($n=1$)	April–Oct ($n=8$)	Cardigan Bay ($n=6$) Bristol Channel ($n=2$)
Recreational ($n=5$)	Late 1960s–2019	24 (±17.7)	Active: 2 Retired: 3	<10 m Vessel ($n=2$) Unknown ($n=3$)	All Year ($n=1$) April–Oct ($n=1$) Summer ($n=2$) Autumn ($n=1$)	Cardigan Bay ($n=3$) Caernarfon Bay ($n=1$) Bristol Channel ($n=1$)
Commercial/Charter ($n=3$)	1968–2017	36 (±11)	Retired: 3	<10 m Vessel ($n=3$)	All Year ($n=2$) April–Nov ($n=1$)	Cardigan Bay ($n=1$) Swansea Bay ($n=2$)
Charter/recreational ($n=1$)	1980–2019	39	Active: 1	<10 m Vessel ($n=1$)	All Year ($n=1$)	Cardigan Bay ($n=1$)

(Table 2). Under these, 16 sub-categories were identified, referred to as 'factors'; 10 factors linked with a decreased likelihood of fishers interacting with *S. squatina*; two factors linked with increased likelihood; and four factors had an unknown impact. Changes in vessel size and characteristics were the most frequently mentioned factor ($n=19$, 70% of respondents), followed by reductions in charter fleet size ($n=8$, 30%), market value and competition ($n=8$, 26%), non-UK vessels fishing within the Welsh Zone ($n=5$, 19%), inland industry collapses ($n=2$, 7%) and operating costs of fishing ($n=2$, 7%), respectively (see Table 2 for further definitions).

In addition, reduced profitability in commercial fisheries and reduced demand for recreational fisheries may have also driven decreases in overall fishing effort. In the commercial sector, seven fishers commented that often markets would buy catches from the first boat to land its catch, with increased competition driving prices down. In addition, five fishers explained that non-UK vessels increasingly operating in the Welsh zone drove market competition and impacted on the value of landings.

Notably, fishers within the recreational sector, 30% ($n=8$) commented that they have observed a reduction in the number of angling clubs visiting Wales over the past half a century, resulting in reduced demand for charter trips, directly impacting fishers' livelihoods and annual income. Thus, declines in the number of charter boats would have resulted in reduced fishing effort and could inadvertently influence the likelihood of fishers interacting with *S. squatina* and/or the number of records. Two fishers mentioned that collapses in inland industries, for example, coal mining and factory closures, had important negative implications for revenue generated by the charter industry, suggesting a link between industrial workers and recreational angling. Furthermore, two fishers commented that operational costs associated with charter fishing have increased over time, resulting in many leaving the sector for more secure employment opportunities. Specifically, the increase in fuel costs in 1978 and increased licensing costs in the 1980s were listed as two major factors for the reduction in charter boats. The social and economic reasons for the reduction in fishing effort in Wales were highlighted by participant p60 (Supporting Information S5: Case Study 1).

3.4 | Ecological drivers

Overall, 16 ecological factors were identified by fishers and grouped into five drivers; nine factors could potentially decrease the probability of fishers sighting *S. squatina*; four factors could increase the likelihood; and three factors remained indeterminate (Table 3). Many of the ecological points discussed in the interviews were related directly to *S. squatina* sightings by fishers and therefore are examined from that perspective. Of the fishers interviewed, 81%

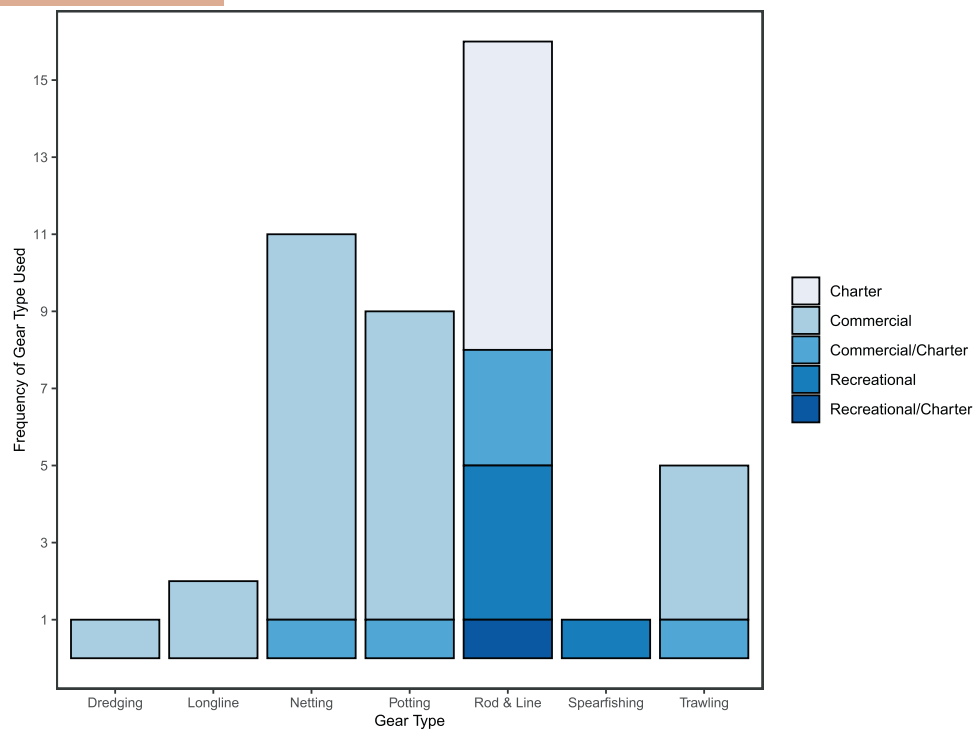

FIGURE 4 Gear types used by the fishers interviewed in this study. Of the commercial fishers, gear type varied between static and towed gear, while charter and recreational fishers predominantly fished using rod and line specifically.

($n=22$) mentioned *R. clavata* populations. Most (74%, $n=20$) identified *R. clavata* as a popular target species in commercial and recreational fisheries, where *S. squatina* were often caught as bycatch. Importantly, 52% of fishers ($n=14$) mentioned the decline of *R. clavata* populations in the 1990s having potential localised impacts on fisheries operating in Wales, specifically in Cardigan Bay. One fisher suggested the lack of quotas for catching *R. clavata* in the 1980-90s was the reason so many were landed, resulting in the fishery collapsing. Changes to target species and fisheries were the second most popular ecological factor mentioned by respondents (48% of interviewed fishers, $n=13$), gear selectivity (44% of interviewed fishers, $n=12$) followed by spatiotemporal changes in fishing location and habitat (33% of interviewed fishers, $n=9$) and species composition changes (22% of interviewed fishers, $n=6$).

Tangle netting in commercial fisheries and sea angling by recreational anglers (shore and charter boat based) was suggested by fishers as gear that most frequently caught *S. squatina*. Fishers commented that the reduction in *R. clavata* populations in Cardigan Bay had negative ecological consequences for species composition in the region. For example, one fisher anecdotally implied that the decline in *R. clavata* abundance in the 1990s contributed to *M. brachydactyla* numbers increasing, resulting in potential trophic level changes within Cardigan Bay. In response to these changes, many fishers changed fishing locations and target fisheries to more offshore habitat. Another commonly recurring theme from the interviews was how spatiotemporal changes in fishing locations impacted target catches. Given that fishing effort changed seasonally, many fishers indicated that Cardigan Bay during the summer season was considered an important area for both *R. clavata* and *S. squatina* catches. Of the respondents, 56% ($n=15$) noted that fishers were more likely to catch *S. squatina* during the summer season between April and November, suggesting a crossover between seasonal charter boat fisheries and the species' distribution in Cardigan Bay. Consequently, it was further inferred that changes to species composition (i.e. the decline of *R. clavata* in the 1990s) within Cardigan Bay shifted target fishing areas for charter fishers to reef or wreck habitats, reducing the chances of fishers encountering or sighting *S. squatina*. Moreover, 44% ($n=12$) of interviewed fishers highlighted how gear type changed seasonally or depending on targeted species, with many vessels operating multiple fishing methods (i.e. potting and netting) concurrently. A fisher commented on how the introduction of monofilament in the 1970s significantly increased catch rates of *R. clavata*, potentially also increasing the catchability of *S. squatina* (see Supporting Information S5: Case Study 2).

3.5 | Policy and legislative drivers

Overall, 13 factors were identified by fishers and grouped into four drivers; six factors could potentially decrease the probability of fishers sighting *S. squatina*; one factor could increase the likelihood; and six factors remain indeterminate (Table 4). Of the legislative drivers mentioned by fishers, the most mentioned factor referred specifically to the charter industry, with 26% ($n=7$) charter fishers citing governance and passenger licensing changes becoming more restrictive from 1960 to 1990s by certain local authorities (e.g. Barmouth).

TABLE 2 Potential explanatory socio-economic factors impacting fishing capacity and effort in Wales, identified from thematic analysis of qualitative data collected from fisher interviews ($n = 27$).

Driver	Factors	Evidence from fisher interviews	Implication for fisheries	Predicted impact on *S. squatina* records	Supporting evidence
Changes in vessel size or characteristics ($n = 19$, 70%)	Fisher backgrounds indicated that the size of vessels (over or under 10 m) varied over the past three decades	'*The Viking left from Barmouth but carried 94 people and underwent 15-hour trips in the 1960s*'	The fishing capacity of a fleet is measured by vessel size in gross tonnage (GT) and engine power (kW). Quotas given to commercial vessels depend on vessel size and characteristics. Changes to the size and characteristics of vessels in the Welsh fleet are difficult to quantify	Temporal changes to the number of vessels and size of vessels operating in Wales could either increase or decrease the probability of sighting *S. squatina* depending on the vessel category and type of fishery. Overall, this has an unknown impact on *S. squatina* records	Gray (1995), Hatcher and Read (2001a) and Ota and Just (2008)
	Fishers worked on different vessel categories (i.e. commercial, recreational or charter)	82% ($n = 22$) of fishers worked on vessels <10 m	Fisher respondents owned and/or worked on different vessels over time	Overall, this has an unknown impact on *S. squatina* records	Derived from Primary data
	Temporal changes to vessel/fisher characteristics (i.e. number of rods, time at sea)	'*1976 Started fishing on a boat that had 10 rods with a 3-mile licence. 1978 Boat IP23 called Nissan. 8 people with a 3-mile licence offshore and 15 miles North & South. 1981 got a new boat Aquastore, an offshore vessel that was able to go 10–12 miles out with a 10–12 rod licence*'	Vessel fishing effort (a standardised unit) is measured by either the number of days or hours at sea and/or the gear type used on the vessel. With many fishers worked on polyvalent fleets.	These changes could either increase or decrease the probability of fishers sighting *S. squatina*, dependent on the number of hours spent fishing and the gear used to catch *S. squatina*. While angling effort targeting *S. squatina* may have reduced, understanding the interactions between commercial fishing activity on *S. squatina* populations is still poorly understood. Given the complexity surrounding these changes, overall, we conclude that there is an unknown impact on *S. squatina* records	Gray (1995), Hatcher and Read (2001a) and Lawson et al. (2020)
	Full/Part-time employment and fishing activity is dependent on vessel category and seasonality	48% ($n = 13$) of fishers interviewed were employed full-time. Charter fishers mainly fished between April and November	Fishing effort does not stay constant throughout the year. The majority ($n = 11$, 92%) of charter fishers interviewed were only employed during the summer months	Charter fishing effort is higher during the summer months increasing the probability of fishers sighting *S. squatina* during seasons that align with postulated *S. squatina* movements	Barker et al. (2022)

(Continues)

TABLE 2 (Continued)

Driver	Factors	Evidence from fisher interviews	Implication for fisheries	Predicted impact on *S. squatina* records	Supporting evidence
Reduction in charter vessels ($n = 8$, 30%)	Fishers explained there has been a reduction in charter trip demand from anglers and angling clubs	'*The Viking fished every day weather permitting but took out clubs on longer "deep sea" trips on Sat, Sun and Weds. Trips stopped due to reduced demand*'	Overall reduction in the number of charter vessels taking out guests targeting elasmobranchs. Reduction in angling effort (rod & line) in inshore fishing locations	Decrease the probability of sighting *S. squatina*. The reduction in the number of days at sea would reduce the number of active recreational anglers fishing for elasmobranchs by boat	Hutton et al. (2008)
	Since 1968, there has been a gradual decline in the number of charter vessels operating in Wales due to regulations, licencing, and operating costs	'*In the mid- 1980s, used to be 87 boats from Aberystwyth (charter & commercial), today there are no charter boats in Aberystwyth*'	Reduction in angling effort (number of charter vessels, hours spent at sea, reduction in the number of anglers on charter boats)	Decrease the probability of recreational anglers sighting *S. squatina*	Marine Management Organisation (2021) and Pitcher and Hollingworth (2008)
		'*23 charter boats in the early 80s. The late 80s was a coal strike that caused a reduction in the number of charter boats*'	Social and economic loss to coastal communities		
	Increase in private boat ownership	'*While private boats and recreational anglers increased this wasn't reflected in charter boats, as the industry decreased*'	More private boats on the water. Catch data unknown unless fishers reported 'trophy' catches to angling magazines	Unknown impact on *S. squatina* records	Derived from primary data
Market value & competition ($n = 7$, 26%)	Historically, local markets were oversaturated with commercial fishers in competition to sell catches. Only profitable to the first commercial vessels to arrive	'*Price of rays decreased as everyone started fishing rays. Problem for the market, as more fishers fished certain species there was competition that drove market price down. Had implications for whether fishing certain species was economically viable*'	Market drove which species were targeted. Competition for catches had implications for the value of fish	As market value for *R. clavata* declined, this would reduce the probability of commercial fishers sighting *S. squatina*, as *S. squatina* were frequently caught by fisheries targeting *R. clavata*	Ellis, Cruz-Martinez, et al. (2005) and Silva and Ellis (2019)
	S. squatina has no commercial value (in regard to a historical commercial fishery in Wales) however, catches would be sold to local restaurants	'*No value in the markets for angelshark (called angelshark "fiddler fish")*'	*S. squatina* catches historically were sold to local markets, if caught accidently. However, the species had no real commercial market value	Not commercially targeted in the UK, decreasing the probability of fishers sighting *S. squatina* and/or recording the catch	Lawson et al. (2020)
	Charter fishing competitions had implications for fishing effort targeting elasmobranch species	'*The 1980s used to have large fishing festivals such as the Tope festival with 30/40 fishing boats in attendance*'	Increase in recreational sea angling effort targeting elasmobranchs	Increase probability of anglers sighting *S. squatina*	Primary data

TABLE 2 (Continued)

Driver	Factors	Evidence from fisher interviews	Implication for fisheries	Predicted impact on *S. squatina* records	Supporting evidence
Non- Welsh Vessels ($n = 5$, 19%)	Non-UK-registered vessels (i.e. beam trawlers) and vessels from other UK administrations (i.e. Scotland, England, Northern Ireland) and EU member states used to fish within the Welsh Zone	'*1989–1993 much bigger Dutch beam trawlers were around Cardigan Bay impacting seabed*'	Competition for catches with foreign vessels. Ecological ramifications for habitats within the Welsh Zone	Decrease probability of sighting *S. squatina*. Large beam trawlers could have negative impacts on seabed habitats that are important for *S. squatina* in Cardigan Bay, reducing, displacing, or fragmenting populations in the impacted regions	Hutton et al. (2008)
	In 1980s, non-UK based angling clubs used to visit coastal towns for large fishing festivals (e.g. tope festival)	'*The 1980s used to have large fishing festivals such as the Tope festival with 30–40 fishing boats in attendance. A Belgium fishing group were a big group that regularly attended*'	Economic contribution to coastal communities reduced. As the number of non-UK based angling clubs reduced fishing effort targeting elasmobranchs would have decreased	Decrease in the number of recreational anglers potentially sighting *S. squatina*	Derived from primary data
Inland industry collapses ($n = 2$, 7%)	Coal mine strikes and industry collapse in the midlands resulted in fewer angling club trips with charter boats	'*Factories disappeared in the midlands around 1979, so, a lot of angling clubs stopped coming to Wales because they couldn't afford prices, so had fewer holidays—this had a huge impact on charter vessels*'	Collapse of industry and closure of factories had implications for charter trip demand, contributing to the reduction in operational charter vessels	Decrease probability of sighting *S. squatina* due to a reduction in charter fishing effort	Huggins et al. (2020) and Hyder et al. (2020)
	Fishers suggested a potential link between industrial workers and recreational angling	'*The late 1980s coal strike caused a reduction in the number of charter boats*'	Reduction in fishing effort due to declines in trip demand by industrial workers	Decrease probability of sighting *S. squatina* due to a reduction in charter fishing effort	Mordue and (2009) and Shorney (2004)
Cost of fishing ($n = 2$, 7%)	Increase in fuel prices resulting in shorter trips (fishing effort reduction)	'*...due to fuel prices in 1978 had to fish closer to shore*'	Fishing effort reduction due to fewer boats out fishing. Time on the water changed from longer fishing trips in the 1970s to shorter trips closer to shore	Decrease probability of sighting *S. squatina*, due to spatiotemporal changes in fishing location dependent on operational costs and reduction in time spent fishing	Derived from primary data (Shorney, 2004)
	Passenger licencing costs increased contributing to reductions in the number of charter vessels	'*Changes in regulations over the years and licencing costs have resulted in a reduction of charter vessels operating*'	Licencing costs contribute to overall operational costs of charter vessels. Fishers suggested this was the reason for the overall reduction in the size of the charter fleet in Wales	Decrease probability of sighting *S. squatina* due to a reduction in charter fishing effort	Derived from primary data

(Continues)

TABLE 3 Potential ecological explanatory factors impacting the fishing capacity and effort in Wales identified from thematic analysis of qualitative data collected from fisher interviews.

Driver	Factors	Evidence from fisher interviews	Implication for fisheries	Predicted impact on *S. squatina* records	Supporting evidence
Thornback ray (*R. clavata*) population ($n = 22$, 81%)	Popular target species by commercial and recreational fishers. 74% ($n = 20$) of all fishers interviewed mentioned they caught. *S. squatina* while actively targeting *R. clavata*	'*1990s thornback rays declined and were outfished*'	Reduction of *R. clavata* populations by fisheries in the 1980s–1990s	Decrease the probability of fishers sighting *S. squatina* after 1990s, as *R. clavata* populations were overfished and fewer vessels would try and catch *R. clavata*	Enever et al. (2009)
	52% ($n = 14$) of fishers interviewed mentioned in the late 1980s/1990s, *R. clavata* populations declined, due to targeted and non-target fishing pressures (tangle netting, rod & line, bycatch in demersal fisheries)	'*Charter was out targeting thornback rays and tope when they caught the angelsharks*' '*Tangle netting effort for rays increased in 1995 in Aber, caused changes in bottom fishing because of the reduction in rays*'	*R. clavata* are caught in multiple fisheries. Population declines in the 1990s, resulted in changes to target fisheries in the Welsh fleet. Reduced fishing effort targeting *R. clavata*	Decrease the probability of sighting *S. squatina*. Increased fishing pressure on *R. clavata* could have negatively Impacted *S. squatina* population(s). The resulting shift in target fisheries would have further reduced the probability of a fisher sighting *S. squatina*	Amelot et al. (2021), Chevolot et al. (2006) and Whittamore and McCarthy (2005)
	Reductions in the abundance of *R. clavata* resulted in target species and habitat changes for both commercial and charter fishers operating in Cardigan Bay	'*Saw a decrease in thornback rays during the 1990s due to tangle netting in the bay. Fishing areas changed due to changes in species* i.e., *fewer thornbacks. Fishing areas changed as a result of decreased thornbacks to fishing on reefs for bream and tope*'	The steep decline in the population of *R. clavata* resulted in a Wales-wide change in target species and habitats, which shifted to more offshore and wreck fishing in the late 1990s	Decrease the probability of sighting *S. squatina*. Changes to target species and habitat to offshore, wreck fishing and potting would reduce the probability of fishers encountering *S. squatina* due to a lack of spatial overlap	Chevolot et al. (2006), Rogers and Ellis (2000) and Silva et al. (2012)
	No commercial fishing quota for targeting *R. clavata* locally in the 1980s/90s. Fishers suggested that this was the reason so many were landed during this period	'*No quota for thornback rays and that was the reason for landing so many in the 80s/90s*'	Implications for species composition. Increased fishing effort had implications for the abundance of *R. clavata*	Decrease the probability of sighting *S. squatina* after the decline in abundance of *R. clavata* reducing in fishing effort in locations that overlap with *S. squatina* predicted habitat use	Amelot et al. (2021) and Silva et al. (2012)
Changes in target species and fisheries ($n = 13$, 48%)	Spatiotemporal changes to target fisheries. Today majority of commercial fishing is potting compared to nomadic fisheries in the 1970s	'*The reason for switching target species was due to decline in the number of rays because of tangle netting in the bay. Switched target species but still caught thornbacks up to 2008*'	Fishing effort has not stayed constant over the past three decades	The probability of sighting *S. squatina* is dependent on target species, location and fishing gear used. This decreased as commercial fishers changed target species to fisheries that rarely overlapped with *S. squatina*	Marine Management Organisation (2021)
	Commercial fishers implied that fleets were dynamic. Reductions in populations of target species would result in changes to fisheries. However, gear used (e.g. tangle netting) was not always species specific	'*Tangle nets to target thornback rays and spurdog till 1993. Then potting for crustaceans and whelk*'	Likelihood of catching target species is dependent on gear type used, commercial fishing effort and fleet capacity	*S. squatina* often caught as bycatch in mixed demersal fisheries and targeted commercial fisheries. Fleet-wide changes in target fisheries to more offshore, wreck and reef, decreased the probability of sighting *S. squatina*	Marine Management Organisation (2021)
	Quotas would influence commercial fisheries and preferred target species	'*1970s–No real Quotas*'	Introduction of catch limits had implications for what fish were targeted and commercial fishing effort	Increased the likelihood of sighting *S. squatina* in the 1970s–1980s due to limited fisheries management	Hatcher and Read (2001a, 2001b)

TABLE 3 (Continued)

Driver	Factors	Evidence from fisher interviews	Implication for fisheries	Predicted impact on *S. squatina* records	Supporting evidence
Fishing gear selectivity (*n* = 12, 44%)	Commercial fishing fleet was mostly polyvalent, utilising multiple gear types to seasonally target different species	48% (*n* = 13) of all fishers interviewed operated different gear types to target different species	Potential catches of *S. squatina* dependent on gear type Rod & Line recreational fishing effort was higher in summer months	Probability of fishers catching S. *squatina* is dependent on gear selectivity. *S. squatina* are most likely to be caught in fisheries operating gear that interact with the seabed: static nets, trawling, rod & line. Overall, we suggest there is an unknown impact, as further analysis is needed to assess the impact of gear type on *S. squatina* catchability	Gray (1995)
	Introduction of monofilament in 1970s	'*Used to fish twine and then brought monofilament from St. Johns in Canada. Monofilament increased catch rates of thornback rays*'	Increased catch rates due to advancement in gear type/design, increasing fishing efficiency	Introduction of new gear types improves selectivity of fisheries and increases catch rates of elasmobranchs. Could likely increase the likelihood of a fisher catching *S. squatina* when targeting other elasmobranchs	Derived from primary data
	Multiple gear changes between 1968 and 2019. Today, the majority of the Welsh commercial fishing fleet is potting, with shellfish and whelk (*Buccinum undatum*) being the main commercial fisheries	48% (*n* = 13) of all fishers operated multiple gear types	Modernisation of the Welsh commercial fishing fleet. Often species-specific gear type used to catch target species (i.e. leaders, monofilament, bait)	Overall decrease the probability of fishers sighting *S. squatina*, as the majority of the fleet has shifted to potting. Little overlap of *S. squatina* with commercial shellfish fisheries	Seafish (2022)
Spatiotemporal changes in fishing location and target habitat (*n* = 9, 33%)	Fishing effort changes depending on location, impacting species caught	*A charter fisher—'Since 2005 changed fishing grounds, now fishes more east of Constable bank and doesn't pick up angelsharks'*	Fishers commonly said they changed to target wreck and reef habitat instead of sand, mud & gravel	Decrease in the probability of sighting *S. squatina* due to a reduction in fishing effort in locations of importance for *S. squatina* populations	Participatory mapping
	Fishing effort in different locations is dependent on seasons. For example, charter fishers are mainly active during April–October	48% (*n* = 13) of all interviewed fishers were employed all year, 33% (*n* = 9) were active between April and October	Reduced fishing effort by charter fishers in winter months, still limited knowledge about seasonal habitat/space use of *S. squatina*	Increase probability of sighting *S. squatina* during summer months due to spatiotemporal overlap of charter boat fisheries with *S. squatina* space use	Barker et al. (2022)
	Spatial overlap of fisheries with *S. squatina* habitat use	*'In the 1990s there was a decline in thornback rays in the bay. In the late 80s anglers changed their fishing locations and therefore less likely to catch rays and angels'*	Demersal trawls, static nets and rod & line fishing often in targeted species in sand/gravel/mud habitats	*S. squatina* distribution is still poorly understood, predicted habitat space use has identified Cardigan Bay as an important area. Fishers operating in that region are more likely to sight *S. squatina*	Barker et al. (2022) and Hiddink et al. (2019)
	Fishing effort and targeted fishing areas for charter fishers change due to passenger licence regulations	*'Changes in fishing efforts and targeted fishing areas (overall changes in the fishing fleet) were due to regulation changes'*	Fishing effort for recreational fishers in different locations is heavily dependent on permits (i.e. passenger licences) granted by local authorities or council	Charter & recreational fishing effort not constant across Wales. Can either increase or decrease the probability of sighting *S. squatina* depending on fishing location and local authority or councils. Overall, unknown impact on *S. squatina* records	Derived from primary data

(Continues)

TABLE 3 (Continued)

Driver	Factors	Evidence from fisher interviews	Implication for fisheries	Predicted impact on *S. squatina* records	Supporting evidence
Species composition changes ($n = 6$, 22%)	In the 1990s, commercial fishers noticed an increase in spider crab (*Maja brachydactyla*) population	'*Noticed an increase in spider crab numbers as thornback rays decreased in the 1990s*'	Fishers suggested that reduction of *R. clavata* resulted in an increase in *M. brachydactyla* populations	Decrease probability of sighting *S. squatina* due to little overlap with shellfish fisheries	Derived from primary data
	Fishers suggested that spurdog (*Squalus acanthias*) populations decrease in the 1980–90s	'*The early 1980s–early 1990s, boom and bust due to the decline of spurdog in the area*'	Changes to target fisheries that caught *S. squatina*	Unknown impact on probability of sighting *S. squatina*	Rogers and Ellis (2000) and Silva and Ellis (2019)

This made it more challenging to get permits to fish in certain areas, directly shaping the number of charter vessels actively fishing. For charter vessels, increases in passenger licence costs often contributed to rising operational costs, which fishers believed to be a major economic driver of reducing the Welsh charter fleet. Furthermore, most charter fishers implied that charter operations overlapped spatially with *S. squatina* during the summer months. Thus, a reduction in charter operations over the years likely reduced the probability of sighting of *S. squatina* within Welsh waters. Interestingly, one charter boat fisher commented about how increasingly stringent and expensive insurance was, which played a pivotal role in the decline of the charter fishing industry in Wales. Additionally, seasonal crew and skippers were expected to undergo training and vessels had to acquire costly certificates, contributing to overall operating costs and leading to declines in the industry. Collectively, these may have resulted in a reduced probability of sighting *S. squatina*.

For commercial vessels, three commercial fishers indicated that shifting quotas and limits had important implications for landings. In the early 1970s, commercial fisheries legislation was introduced by the European Commission, but it was only in 1983 that catch limits were introduced for the first time under the CFP. In the early 1970s, no real national quotas for fish stocks existed in the UK until the enactment of early commercial fisheries management strategies under the CFP in 1983. Furthermore, it was only in 2008 that *S. squatina* received protection in the United Kingdom when it was listed on Schedule 5 of the Wildlife Countryside Act 1981. Thus, historical catches of *S. squatina* are likely underreported by commercial fishers.

4 | DISCUSSION

To effectively conserve species, management decisions need to be based on the best data available. For cryptic or rare elasmobranch species, this is primarily from fisheries. However, traditional fisheries-derived data for such species are often limited and scarce. Thus, inferences made upon them alone can be misleading without holistically considering the wider context and the coinciding changes in fisher behaviours that may have influenced interaction rates with these animals. Drawing on 51 years of fisher knowledge, this study offers a novel perspective on the complex narrative behind changes to the fishing landscapes in the United Kingdom from 1968 to 2019, and the potential impact these changes could have had on *Squatina squatina* sightings in Welsh coastal waters, drawing examples from underrepresented fisher voices. We identified 45 factors that potentially had an impact on the likelihood of fishers interacting with *S. squatina*. Of the factors identified, 16% ($n = 7$) inferred an increasing likelihood of sighting *S. squatina*, 56% ($n = 25$) factors inferred a decreased likelihood, and 29% ($n = 13$) factors could not be inferred (unknown impact). While we acknowledge and agree with the consensus that *S. squatina* is now a relatively rare and elusive species within Welsh waters, 56% of identified changes to fishing effort were inferred to have reduced the likelihood of fishers sighting individuals. As such, we suggest that the postulated population declines

TABLE 4 Potential legislative and political explanatory factors impacting the fishing capacity and effort in Wales identified from thematic analysis of qualitative data collected from fisher interviews.

Drivers	Factors	Evidence from fisher interviews	Implication	Predicted impact on *S. squatina* records	Supporting evidence
Licencing changes ($n = 7$, 26%)	Local authorities were responsible for passenger licencing activities at its respective port	'*Licences were available from the local council to dock at the harbour*'	Licences were required to take out passengers and fishers were required to obtain permits to Fish. However, these were dependent on local authorities. This had implications for the number of passengers onboard and distance from port	Charter fishing effort impacting *S. squatina* populations will vary depending on location due to differences in licencing requirements and local by-laws. Decrease or increase the probability of sighting *S. squatina* due to more stringent protocols in certain areas. Overall, unknown impact on *S. squatina*	Hatcher and Read (2001a, 2001b)
	Council was responsible for licencing charter boats to take out paying guests	'*Licences were given from the tourist board to take out guests, but Health and Safety became a big concern. This was council dependent with some areas tougher than others*'	Certain council licences were more restrictive than others (e.g. Barmouth). Impacted the number of charter boat vessels actively fishing	Decrease the probability of sighting *S. squatina* by influencing charter boat fishing effort in certain regions	Hatcher and Read (2001a, 2001b)
	Licencing costs increased for charter boats	'*Changes in regulations over the years and licencing costs have resulted in a reduction of charter vessels operating*'	Reduction in the number of charter boats due to operational cost increases	Decrease the probability of sighting *S. squatina* due to a reduction in charter fishing effort	Maritime and Coastguard Agency (2012)
Shifting quotas ($n = 3$, 11%)	Quota limits for commercial vessels (total allowable catch (TAC)) are set annually by The European Commission under Common Fisheries Policy based on area	'*Shifting quotas (allocated to Welsh fishermen) changed every year. If the quota went down, effort went down*'	Catch limits determine species-specific commercial fishing effort which changed annually. If TAC limits are reduced, commercial fishing effort in the respective commercial fishery is reduced. Thus, commercial fishing effort doesn't stay constant over time	The probability of fishers sighting *S. squatina* is dependent on the type of commercial fishing activity. Catch limits imposed on bottom trawlers would either increase or decrease the probability of sighting *S. squatina* dependant on fishing effort and capacity. Overall, unknown impact on *S. squatina*	Hatcher (1997), Hatcher and Read (2001b) and Squires et al. (1998)
	Quotas allocated to commercial fishing vessels (over 10 m) by UK administrations. Vessels (under 10 m) have an entitlement under an administrative level for pooled resources	'*Shifting quotas (allocated to Welsh fisherman) changed every year*'	Quotas traded between commercial fishers in different locations, however, this mainly applies to commercial fishing vessels over 10 m. Quotas for Welsh commercial fisheries are subject to change annually and influence our understanding of landing records and species-specific commercial fishing effort	The lack of quotas and reporting requirements for elasmobranch catches under the early CFP regulations could result in inaccuracies the number of historical *S. squatina* sightings. Overall, unknown impact on *S. squatina*	Hatcher (1997) and Squires et al. (1998)

(Continues)

TABLE 4 (Continued)

Drivers	Factors	Evidence from fisher interviews	Implication	Predicted impact on *S. squatina* records	Supporting evidence
	Non-quota species for commercial fisheries are regulated by the Member States and do not have limits set at the EU level. This includes many species including shellfish (the main fishery in Wales). No quota restrictions for *R. clavata* meant there was no limit to the number caught annually	*'No quota for thornback rays and that was the reason for landing so many in the 80s/90s'*	Local by-laws apply for certain species within specific commercial fishing areas	Increased probability of commercial fishers sighting *S. squatina* when targeting *R. clavata* in the 1980s/90s	Primary data
			Article 15 of the CFP landing obligation for demersal commercial fishing quota species (also referred to as 'discard ban') has potential implications for non-commercially targeted species that are caught as bycatch. Non-quota species that are undersized fish would have to be returned to sea	Overall, the introduction of the quotas for elasmobranchs in commercial fisheries, discard bans and commercial fisheries management plans for vulnerable elasmobranchs would decrease the likelihood of fishers sighting *S. squatina*. However, it would have also improved the reporting of elasmobranch catches, with reporting leading to more accurate records than historical datasets	EU Commission (2013, 2015, 2019)
Fisheries legislation and jurisdiction ($n = 3$, 11%)	The first EU wide commercial fisheries regulations were introduced under the Common Fisheries Policy (CFP) and its reforms in 1992, 2002 and 2013	*'In the 1980s Common Fisheries Policy introduced—impact on quotas/catch limits. Lots of sea committee by-laws. Introduction of minimum landing sizes for certain species'*	CFP responsible for commercial fisheries quotas and which species were targeted commercially including many non-quota species (i.e. Bass, Turbot). Has direct implications for commercial fishing effort and target species in Wales	Decrease probability of sighting *S. squatina* as CFP reforms introduced catch limits, and commercial fishing effort reduced in fisheries catching S. *squatina* (i.e. tangle netting for thornback rays in the 1990s)	EU Commission (2013)
	Implementation of Exclusive Economic Zones (EEZ) in 1976	------	Implementation of EEZ, and 6–12 nautical limits had implications for the number of non-UK vessels fishing around the Welsh and English Coast	Unknown impact on *S. squatina*	Marine and Coastal Access Act (2009)
	Devolution of UK fisheries and establishment of the Welsh Zone	------	The devolution of UK fisheries has direct ramifications for our understanding of historical catch records and the capacity of the Welsh commercial fishing fleet, especially given that landing data for England and Wales was recorded together historically	Implications for the number of *S. squatina* records, current records likely under report the actual number of a *S. squatina* sightings. Overall, unknown impact on *S. squatina*	Government of Wales Act (2006)

TABLE 4 (Continued)

Drivers	Factors	Evidence from fisher interviews	Implication	Predicted impact on *S. squatina* records	Supporting evidence
	'Protection of *S. squatina*' as it relates to all fishers/ fisheries. 'Commercial fisheries landing records' as it relates just to commercial fishers/fisheries	*'2008—Wildlife and Countryside Act 1981 (angelshark some rays). After this no records of angelsharks/rays. (Fisher opinion) once these species were put on this act, was there compliance? Did commercial fishers' throwback angelsharks and not record it?'*	Under national and international legislation, it is prohibited to target, land, retain, or tranship angelsharks (*Squatina squatina*). If accidentally caught, specimens must be immediately released, and estimated discards should be recorded	After 2008, decreased probability of fishers sighting *S. squatina*, due to their prohibited status. Prior to this, records for *S. squatina* likely underreported the number of actual sightings	The Wildlife and Countryside Act (EU Commission, 2018; GovUK., 1981)
		'Commercial operations didn't used to report sharks and rays. If an angelshark was caught it was normally labelled under 'misc.'. Up till more reliable the implementation of the Wildlife Countryside Act 1981 (listed 2008) records were not species- specific'	According to Technical Measure Regulation (EU) No. 2015/812 and Article 15 (4) and (5) of Regulation (EU) No. 1380/2013 of the European Parliament, commercial fishing vessels over 10 meters in length are required to record all accidental catches (released) and estimated discards of *S. squatina* in their logbooks. Prior to 2020, European Union Regulation No. 2019/1241 did not mandate logbook records for under 10-meter commercial vessels	Depending on commercial fishing vessel compliance, records for *S. squatina* in commercial operations likely underestimate historical catches due to grouped/unreliable labelling. *S. squatina* are exempt from the landing obligation, all accidental catches must be released unharmed, with estimated discards recorded. Overall, unknown impact on *S. squatina* due to difficulties in extracting species-specific information from these records	EU Commission (2013, 2015, 2019)
Insurance ($n = 1$, 4%)	Insurance for charter boats was only licenced from April–September	*'Insurance for charters was only licenced from April–September'*	Reduction in annual charter boat fishing effort due to seasonal insurance window	Potential overlap of charter fishing season with *S. squatina* sightings in the summer months. Increased probability of charter fishers sighting *S. squatina*. However, overall constraints to fishing activity could reduce the probability of fishers sighting *S. squatina* over the past three decades	Primary data
	Health & Safety Certificates needed for crews and licences on charter boats (cost associated)	*'Accidents could have tightened up regulations by certain authorities, Health & Safety was a big concern for insurance reasons'*	A requirement that might have reduced the number of experienced charter boat skippers/crew due to costs associated with training	Reduction in the number of anglers and charter boat vessels would decrease probability of sighting *S. squatina*	Maritime and Coastguard Agency (2012)
	Insurance costs for charter fishing boats	*'Certificates need for crews and licences on charter boats, had a cost associated'*	Contributed to overall to the increase in operating costs for charter vessels. Potentially a reason for the decline charter boats	Decrease probability of sighting *S. squatina* due to a reduction in the number of charter vessels operating	Primary data

for *S. squatina* may be over-exaggerated due to a net reduction in the detectability of the species over the past several decades. We therefore suggest that the wide range of socio-economic, ecological and legislative factors should be incorporated into future trend-based analyses for *S. squatina* populations in Wales.

Considering that *S. squatina* populations have declined throughout its geographic range, calculating the rate and magnitude of these declines with charter boat fishing effort requires further reflection, especially given the notable spatial overlap between historical charter fisheries and *S. squatina* in Wales (Barker et al., 2022). A population trajectory for *S. squatina* estimated a 70% (1.5% per year) decline in abundance for the species in Wales over a 46-year period (Hiddink et al., 2019), yet this estimate fails to sufficiently incorporate the reduction in angling effort (both recreational shore and boat-based effort) and commercial activity overlapping with *S. squatina* predicted space use over time (Hiddink et al., 2019). Thus, opportunistic records of *S. squatina* catches and sightings used to model these changes could underestimate the underlying population abundance, resulting in inflated declines for this species. Our analysis indicates that charter boat fishing effort has declined over the past three decades. While no validated complete data sets exist for the number of charter boats actively fishing in Wales across our study time period, online searches for advertised charter trips estimate that approximately 37 boats are still in operation today, representing a 46% decrease over the last 50 years (compared to Gammon, 1974). Given this, fishers implied that the frequency of trips has reduced over the past few decades—due to a decline in demand, operational costs and bureaucratic changes that govern the sector—contributing to substantial shifts in angling effort in localised regions. *S. squatina* were commonly caught by charter boat fishers prior to their inclusion as a protected species, with all interviewees indicating that they had seen or caught *S. squatina* prior to 2008. Gradual declines in the number of active vessels, frequency of trips and the number of guests fishing, from 1968 to 2008 would result in a net decrease in sightings of *S. squatina*, reducing the likelihood of a fisher sighting an individual. For example, The Endeavour charter group, a collective group of three vessels based out of Aberystwyth, was mentioned in three separate interviews as a notable operation specialising in catching *S. squatina*, with there being 38 records of *S. squatina* catches from the group in the Sea Angler magazine from 1968 until the charter business closed in the late 1990s (Angler, 1996). Today, there are no remaining charter boats in Aberystwyth, which at one time had 14 charter boats fishing in Cardigan Bay, highlighting how changes to the number of charter boats vary depending on the region.

The reported decline of *R. clavata* in the late 20th century may have had substantial impacts on species composition and fishing effort within Cardigan Bay, Wales (Ellis, Cruz-Martinez, et al., 2005; Ellis, Dulvy, et al., 2005; Enever et al., 2009; Silva et al., 2012; Walker & Heessen, 1996). As a valuable commercial fishery in the late 20th century and a popular target species for recreational anglers, there were limited management plans or catch limits for the species (Fowler et al., 2004). *R. clavata* populations were commonly targeted in inshore commercial longline and static net fisheries in coastal waters around Wales, in addition to the species being an important bycatch component in mixed demersal trawls (Amelot et al., 2021; Enever et al., 2009; Whittamore & McCarthy, 2005). This commercial fishery also recorded sightings of *S. squatina* (Silva & Ellis, 2019). Fisher narratives indicate that in response to this decline, many charter boat operations that targeted *R. clavata* switched fishing locations to deeper offshore waters or to fish wreck and reef habitats, selectively targeting species including bass (*Dicentrarchus labrax*) and tope (*Galeorhinus galeus*). This resulted in sector-wide changes in the spatial locality and target species that may have reduced the probability of charter boat fishers encountering *S. squatina*. To understand historical declines of R. *clavata*, surplus-production models have been used to model data-deficient landing data of skates from demersal trawls (commercial fishing activity), corroborating the reported decline of this fishery by fishers and providing evidence to support these historical accounts (Dulvy et al., 2000; Pedersen & Berg, 2017; Sguotti et al., 2016; Silva et al., 2012). Furthermore, species-specific survey data gathered from the Irish Sea and Bristol Channel noted an important decline in abundance for *R. clavata* during the latter half of the 20th century, alongside other large-bodied skates (Dulvy et al., 2000; Stevens et al., 2000; Whittamore & McCarthy, 2005).

It is generally agreed that both *S. squatina* and *R. clavata* may occupy a similar niche within Wales, with both species vulnerable to overexploitation by the same mixed demersal commercial fisheries (Enever et al., 2009; Silva et al., 2012). Considering this, in accordance with conclusions by Hiddink et al. (2019) it could also be perceived that *S. squatina* populations might have also been impacted in the 1990s, alongside *R. clavata*. Without species-specific data for *S. squatina*, understanding localised and regional declines for other elasmobranchs caught in the same fisheries may allow for future comparative analyses, providing an ecosystem-based approach for determining the impact of fishing activity on species composition. Our study proposes that historical recreational fishing effort targeting *S. squatina* was much higher in the 1970s to early 1990s, supporting the current postulations that fishing and observation effort varies over time for elasmobranchs. We highlight how nuanced and intertwined the relationship between seasonality, fishing location and gear types were on the likelihood of a fisher landing target species. Historically, *S. squatina* was commonly caught as bycatch in mixed demersal fisheries with 74% ($n = 20$) of the fishers specifying that the species was often caught while targeting *R. clavata* in both commercial and recreational fisheries (Enever et al., 2009; Silva et al., 2012). Given that historical records for both *R. clavata* and *S. squatina* are considered data-deficient, understanding whether there is a potential overlap in the distribution, prey preference and habitat use of the two species may warrant further investigation and aid in the interpretation of stock assessments and population trends.

A suite of legislative changes has occurred over the past half a century, which have had arguably widespread impacts on coastal fisheries in Wales and the likelihood of encountering *S. squatina*. The

establishment of the South Wales, Northwestern and North Wales Sea Fisheries Committees (SFC) under the Sea Fisheries Regulation Act, 1966 ('the 1966 Act'), saw the first introduction of commercial fisheries by-laws in different regions across Wales, with the SFC responsible for regulating the inshore (0-6 nm) fishing zones until the committee's dissolution in 2010 (Terry et al., 2017). In the 1970s, there were very limited regulations on commercial fishing activity within Welsh waters. Consequently, from 1970 to the mid/late 1990s there were no set quotas or catch limits for elasmobranchs within Wales, and commercial fishers were under no obligation to keep species-specific records on sightings, landings or discards of these species (Fowler et al., 2004; Silva & Ellis, 2019). Considering that the compiled historical records for *S. squatina* analysed in this study span a 51-year period, elucidating the influence of legislative changes on these records is crucial for gauging the accuracy of past catch reporting across Wales.

Gradual decadal reforms of the CFP policy in 1992, 2002 and 2013 have resulted in significant changes to fisheries management (EU Commission, 2013). The successes and failures of the policy's gradual reforms have been widely debated and critiqued by fisheries biologists, fishers and elected officials, with extensive studies detailing how early legislation and management efforts failed to protect vulnerable stocks from overexploitation by fisheries (see Churchill & Owen, 2010; Daw & Gray, 2005). Despite the direct impact of CFP policies and its reforms on commercial fisheries operating within Wales, only three fishers highlighted the importance of it or referred to 'quotas' more generally. While investigating the impacts of specific regulations on commercial fishing fleet characteristics and behaviour within Wales is beyond the scope and purpose of this study, commercial fishers highlighted that the implementations of legislation had broadscale impacts on the composition and behaviour of fleets operating within the Welsh Zone.

Commercial landings data for *S. squatina* catches collated by the International Council for the Exploration of the Sea (ICES) Working Group on Elasmobranch Fisheries have indicated decadal declines of species records across the Northeast Atlantic (ICES, 2017). Yet, detailed fishery-dependent datasets for commercial fisheries targeting *S. squatina* within the Welsh Zone are scarce. It is highly likely that *S. squatina* were commonly caught as bycatch in historical mixed demersal commercial fisheries. However, pulling species-specific *S. squatina* data from historical records is challenging, as a plethora of identification labels in commercial fisheries have been used to refer to the species. Given that 'monkfish' is also a moniker for a popular commercially targeted teleost fish, *Lophius piscatorius*, it is likely that these records are under-recording the true number of *S. squatina* caught. While some fishers reported voluntarily, until recently, commercial vessels had no statuary obligation to record bycatch or discards despite the large volume of unreported species being extracted (harvested or released) in these fisheries (Barker & Schluessel, 2005; CEC, 2009; DEFRA, 2011; Fischer et al., 2012; ICES, 2017). While *S. squatina* are exempt from the landing obligation due to their inclusion as a protected species on Wildlife and Countryside Act 1981 and auxiliary protections afforded under international legislations (see, EU Commission, 2013; ICES, 2017) it is probable that historical landing data are underestimating the number of records.

Although this study aimed to shed light on the nuanced changes in fishing practices across Wales, it is important to note the unavoidable bias associated with our analysis. For one, due to the snowball sampling methods used to recruit fishers for this study and the willingness of fishers to contribute (Miles & Huberman, 1994), there is a considerable bias toward North Wales where most of the project's engagement is highest. Nonetheless, we argue that the complex behaviours of both commercial and recreational fisheries need to be better characterised and considered in elasmobranch population assessments and incorporated into sustainable management initiatives, particularly for non-commercially targeted species. Finally, we advocate for the greater inclusion of fisher perspectives into traditional quantitative approaches within fisheries research and highlight the innovative value of LEK and narratives in regaining data on historical fish populations.

AUTHOR CONTRIBUTIONS

Francesca C. Mason, Jake Davies and David J. Curnick are responsible for primary data analysis and led the writing of the manuscript. Joanna Barker, Jake Davies, Ben Wray, Surshti Patel and David J. Curnick conceived the ideas and co-designed the methodology. Jake Davies, Joanna Barker, Surshti Patel and Sarah Davies led the data collection with fishers who were invited to be co-authors on this paper. Kathryn Whittey, Alice Chamberlain, Charlotte Pike and Matthew Gollock supported data interpretation and write-up. Claire Collins assisted with methodology and data analysis. Charlie Bartlett, Mike Davies, Dafydd Jones, Rowland Sharp and Carl Worrall are fisher respondents interviewed in this study. Jim Evans (Welsh Fishermans Association/Cymdeithas Pysgotwyr Cymru) and John O'Connor (Angling Cymru Sea Anglers) co-developed the fisher engagement work and provided vital feedback, representing two major fisher associations in Wales. All authors contributed critically to the drafts and gave final approval for publication.

ACKNOWLEDGEMENTS

This study is an output of two collaborative projects: Angel Shark Project: Wales and Project SIARC (Sharks Inspiring Action and Research with Communities). Angling Cymru Sea Anglers and Welsh Fishermen's Association, as representatives of fishers in Wales, were involved in co-designing these projects at the development stage and were involved throughout delivery through supporting methodological design, sharing contacts, providing iterative feedback and co-developing next steps. We thank all the fishers who were part of and co-developed this study as part of the Angel Shark Project: Wales and Project SIARC. We also would like to thank the Angel Shark Project: Wales and Project SIARC steering group members for their assistance and contributions to this study: Aberystwyth School of Veterinary Science (ASVS), All the Elements (ATE), Angling Cymru Sea Anglers (ACSA), Bangor University, Blue Abacus, Cefas, Cetacean Strandings Investigation Programme (CSIP), Inland Fisheries Ireland, Irish Elasmobranch Group, Leibniz Institute for the

Analysis of Biological Change, National Waterfront Museum (NWM), People's Collection Wales (PCW), Peoples Collection of Wales, Swansea University, The National Botanic Garden of Wales (NBGW), The North Wales Wildlife Trust, The Shark Trust, Universidad de Las Palmas de Gran Canaria, University College Dublin School of Veterinary Medicine (UCDSVM), and Welsh Fishermen's Association / Cwmdeithas Pysgotwr Cymru (WFA-CPC).

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The data supporting this study is not publicly available due to data protection regulations, but a redacted version may be made available upon reasonable request and subject to ethics committee approval.

ORCID

Francesca C. Mason https://orcid.org/0009-0006-1378-8986
Jake Davies https://orcid.org/0009-0000-9521-3057
Surshti Patel https://orcid.org/0000-0001-9419-8182
Ben Wray https://orcid.org/0009-0002-7505-2289
Sarah Davies https://orcid.org/0009-0004-0953-5156
Alice Chamberlain https://orcid.org/0000-0002-1244-7761
Charlotte Pike https://orcid.org/0009-0000-9308-5354
Kathryn E. Whittey https://orcid.org/0000-0002-1557-757X
Claire Collins https://orcid.org/0009-0002-0189-0028
Joanna Barker https://orcid.org/0000-0003-1396-6851
David J. Curnick https://orcid.org/0000-0002-3093-1282

REFERENCES

Amelot, M., Batsleer, J., Foucher, E., Girardin, R., Marchal, P., Poos, J. J., & Sys, K. (2021). Evidence of difference in landings and discards patterns in the English Channel and North Sea Rajidae complex fishery. *Fisheries Research*, *242*, 106028. https://doi.org/10.1016/j.fishres.2021.106028

Angler, S. (1996). *SeaAngler magazine*, issue: May 1996.

APBmer Ltd, N.R.W. (2020). *Assessment of the impacts of recreational sea angling in Wales*. NRW Evidence Report Series. 455, Natural Resources Wales, Bangor. This document has been produced by ABPmer based on an initial document prepared under contract by APEM Ltd.

Barker, J., Davies, J., Goralczyk, M., Patel, S., O'Connor, J., Evans, J., Sharp, R., Gollock, M., Wood, F. R., Rosindell, J., & Bartlett, C. (2022). The distribution, ecology and predicted habitat use of the critically endangered angelshark (*Squatina squatina*) in coastal waters of Wales and the central Irish Sea. *Journal of Fish Biology*, *101*(3), 640–658. https://doi.org/10.1111/jfb.15133

Barker, J., Davies, J., Wray, B., Sharp, R., Gollock, M., Evans, J., O'Connor, J., Evans, S., & Gordon, C. (2020). *Wales Angelshark action plan*. Natural Resources Wales.

Barker, M. J., & Schluessel, V. (2005). Managing global shark fisheries: Suggestions for prioritizing management strategies. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *15*(4), 325–347. https://doi.org/10.1002/aqc.660

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

CEC. (2009). *Communication from the Commission to the European Parliament and the Council on a European Community Action Plan for the Conservation and Management of Sharks*. Commission of the European Communities.

Chevolot, M., Ellis, J. R., Hoarau, G., Rijnsdorp, A. D., Stam, W. T., & Olsen, J. L. (2006). Population structure of the thornback ray (Raja clavata L.) in British waters. *Journal of Sea Research*, *56*(4), 305–316. https://doi.org/10.1016/j.seares.2006.05.005

Churchill, R., & Owen, D. (2010). *The EC common fisheries policy*. Oxford University Press.

Connelly, N. A., Brown, T. L., & Knuth, B. A. (2000). Assessing the relative importance of recall bias and nonresponse bias and adjusting for those biases in statewide angler surveys. *Human Dimensions of Wildlife*, *5*(4), 19–29. https://doi.org/10.1080/10871200009359192

Daw, T., & Gray, T. (2005). Fisheries science and sustainability in international policy: A study of failure in the European Union's common fisheries policy. *Marine Policy*, *29*(3), 189–197. https://doi.org/10.1016/j.marpol.2004.03.003

DEFRA. (2011). *Shark, skate and ray conservation plan*. DEFRA.

Dulvy, N. K., Metcalfe, J. D., Glanville, J., Pawson, M. G., & Reynolds, J. D. (2000). Fishery stability, local extinctions, and shifts in community structure in skates. *Conservation Biology*, *14*(1), 283–293. https://doi.org/10.1046/j.1523-1739.2000.98540.x

Dulvy, N. K., Pacoureau, N., Rigby, C. L., Pollom, R. A., Jabado, R. W., Ebert, D. A., Finucci, B., Pollock, C. M., Cheok, J., Derrick, D. H., & Herman, K. B. (2021). Overfishing drives over one-third of all sharks and rays toward a global extinction crisis. *Current Biology*, *31*(21), 4773–4787. https://doi.org/10.1016/j.cub.2021.08.062

Dunn, N., Ward, S., Davies, J., Davies, S., Hopkins, K., Apetroaie, I., Williams, J., Wray, B., Barker, J., Robins, P., & Curnick, D. J. (2025). Using environmental DNA and particle tracking to uncover the spatial and temporal distribution of elasmobranchs in temperate coastal waters. *Ecology and Evolution*. https://doi.org/10.1002/ece3.70857

Early-Capistrán, M., Solana-Arellano, E., Abreu-Grobois, F. A., Narchi, N. E., Garibay-Melo, G., Seminoff, J. A., Koch, V., & Saenz-Arroyo, A. (2020). Quantifying local ecological knowledge to model historical abundance of long-lived, heavily exploited fauna. *PeerJ*, *8*, e9494. https://doi.org/10.7717/peerj.9494

Ellis, J. R., Barker, J., McCully Phillips, S. R., Meyers, E. K. M., & Heupel, M. (2021). Angel sharks (Squatinidae): A review of biological knowledge and exploitation. *Journal of Fish Biology*, *98*(3), 592–621. https://doi.org/10.1111/jfb.14613

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.

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

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*(1), 72–76. https://doi.org/10.1016/j.fishres.2009.01.001

Engelhard, G. H., Thurstan, R. H., MacKenzie, B. R., Alleway, H. K., Bannister, R. C. A., Cardinale, M., Clarke, M. W., Currie, J. C., Fortibuoni, T., Holm, P., & Holt, S. J. (2016). ICES meets marine historical ecology: Placing the history of fish and fisheries in current policy context. *ICES Journal of Marine Science*, *73*(5), 1386–1403. https://doi.org/10.1093/icesjms/fsv219

Environment (Wales) Act 2016. (2016). *UK Parliament*. The National Assembly for Wales.

EU Commission. (2013). Regulation (EU) no 1380/2013 of the European Parliament and of the Council of December 11, 2013, on the common fisheries policy, amending council regulations (EC) no

1954/2003 and (EC) no 1224/2009 and repealing council regulations (EC) no 2371/2002 and (EC) no 639/2004 and council decision 2004/585/EC. *Official Journal of the European Union*, *L354*, 22–61.

EU Commission. (2015). Regulation (EU) No. 2015/812 of the European Parliament and of the Council on technical measures for the conservation of marine biological resources. *Official Journal of the European Union*, *L133*, 1–25.

EU Commission. (2018). Council regulation (EU) 2018/120 of January 23 2018, fixing for 2018 the fishing opportunities for certain fish stocks and groups of fish stocks, applicable in union waters and, for union fishing vessels, in certain non-union waters and amending regulation (EU) 2017/127. *Official Journal of the European Union*, *L27*, 1–168.

EU Commission. (2019). Regulation (EU) No. 2019/1241 of the European Parliament and of the Council of 20 June 2019. *Official Journal of the European Union*, *L198*, 1–20.

Exeter, O. M., Htut, T., Kerry, C. R., Kyi, M. M., Mizrahi, M. I., Turner, R. A., Witt, M. J., & Bicknell, A. W. (2021). Shining light on data-poor coastal fisheries. *Frontiers in Marine Science*, *7*, 625766. https://doi.org/10.3389/fmars.2020.625766

FAO. (2000). Fisheries management 1, conservation and management of sharks. *FAO Technical Guidelines for Responsible Fisheries*, *4*(Supp 1), 37.

Fischer, J., Erikstein, K., D'Offay, B., Guggisberg, S., & Barone, M. (2012). *Review of the implementation of the international plan of action for the conservation and management of sharks*. FAO Fisheries and Aquaculture Circular (C1076).

Flanders Marine Institute. (2023). *Maritime boundaries geodatabase, version 12*. https://www.marineregions.org/ https://doi.org/10.14284/628

Fortibuoni, T., Borme, D., Franceschini, G., Giovanardi, O., & Raicevich, S. (2016). Common, rare or extirpated? Shifting baselines for common angelshark, *Squatina squatina* (Elasmobranchii: Squatinidae), in the northern Adriatic Sea (Mediterranean Sea). *Hydrobiologia*, *772*, 247–259. https://doi.org/10.1007/s10750-016-2671-4

Fowler, S., Mogensen, C. B., & Blasdale, T. (2004). *Plan of action for the conservation and management of sharks in UK waters*. Report-Joint Nature Conservation Committee 360.

Gammon, C. (1974). *Angling guide to Wales*. Wales Tourist Board.

Gordon, C. A., Hood, A. R., Al Mabruk, S. A. A., Barker, J., Bartolí, A., Ben Abdelhamid, S., Bradai, M. N., Dulvy, N. K., Fortibuoni, T., Giovos, I., & Jimenez Alvarado, D. (2019). *Mediterranean angel sharks: Regional action plan*. The Shark Trust.

Goudge, H., & Morris, E. S. (2011). *North Wales Recreational Sea Angler (RSA) pilot*. CCW Policy Research Report No. 11/9.

Government of Wales Act 2006. (2006). *Government of Wales Act 2006*. The Stationery Office.

GovUK. (1981). *The Wildlife and Countryside Act 1981*. Her Majesty's Stationery Office, London. HMSO. www.legislation.gov.uk/ukpga/1981/69

Gray, M. J. (1995). *The coastal fisheries of England and Wales, Part III: A review of their status 1992–1994*. Fisheries Research Technical Report MAFF.

Hareide, N. R., Carlson, J., Clarke, M., Clarke, S., Ellis, J., Fordham, S., Fowler, S., Pinho, M., Raymakers, C., Serena, F., & Seret, B. (2007). *European Shark Fisheries: a preliminary investigation into fisheries, conversion factors, trade products, markets and management measures*. European Elasmobranch Association, 27.

Hatcher, A., & Read, A. (2001a). Fishing rights and structural changes in the UK fishing industry. In *Case studies on the effects of transferable fishing rights on fleet capacity and concentration of quota ownership* (pp. 1–14). Food and Agriculture Organization of the United Nations.

Hatcher, A., & Read, A. (2001b). The allocation of fishing rights in UK fisheries. In *Case studies on the allocation of transferable quota rights in fisheries* (pp. 1–14). Food and Agriculture Organization of the United Nations.

Hatcher, A. C. (1997). Producers' organizations and devolved fisheries management in the United Kingdom: Collective and individual quota systems. *Marine Policy*, *21*(6), 519–533. https://doi.org/10.1016/S0308-597X(97)00019-5

Hernvann, P. Y., & Gascuel, D. (2020). Exploring the impacts of fishing and environment on the Celtic Sea ecosystem since 1950. *Fisheries Research*, *225*, 105472. https://doi.org/10.1016/j.fishres.2019.105472

Hiddink, J. G., Shepperson, J., Bater, R., Goonesekera, D., & Dulvy, N. K. (2019). Near disappearance of the Angelshark Squatina squatina over half a century of observations. *Conservation Science and Practice*, *1*(9), e97. https://doi.org/10.1111/csp2.97

Hilborn, R., & Walters, C. J. (Eds.). (2013). *Quantitative fisheries stock assessment: Choice, dynamics and uncertainty*. Springer Science & Business Media.

Holmes, A. G. D. (2020). Researcher positionality—A consideration of its influence and place in qualitative research—A new researcher guide. *Shanlax International Journal of Education*, *8*(4), 1–10.

Huggins, C., Connolly, J., McAngus, C., & van der Zwet, A. (2020). Brexit and the uncertain future of fisheries policy in the United Kingdom: Political and governance challenges. *Ocean Yearbook*, *34*(1), 20–42. https://doi.org/10.1163/9789004426214_003

Hutton, T., Mardle, S., & Tidd, A. N. (2008). The decline of the English and Welsh fishing fleet? In A. Payne, J. Cotter, & T. Potter (Eds.), *Advances in fisheries science: 50 years on from Beverton and Holt* (pp. 26–48). Crown Publishing. https://doi.org/10.1002/9781444302653.ch2

Hyder, K., Maravelias, C. D., Kraan, M., Radford, Z., & Prellezo, R. (2020). Marine recreational fisheries—Current state and future opportunities. *ICES Journal of Marine Science*, *77*(6), 2171–2180. https://doi.org/10.1093/icesjms/fsaa147

ICES. (2017). *Report of the Workshop to compile and refine catch and landings of elasmobranchs (WKSHARK3), 20–February 24, 2017, Nantes, France*. ICES CM 2017/ACOM NO. 38. https://doi.org/10.17895/ices.pub.19290452

Jackson, J. B., Kirby, M. X., Berger, W. H., Bjorndal, K. A., Botsford, L. W., Bourque, B. J., Bradbury, R. H., Cooke, R., Erlandson, J., Estes, J. A., & Hughes, T. P. (2001). Historical overfishing and the recent collapse of coastal ecosystems. *Science*, *293*(5530), 629–637. https://doi.org/10.1126/science.1059199

Jiménez-Alvarado, D., Meyers, E. K. M., Caro, M. B., Sealey, M. J., & Barker, J. (2020). Investigation of juvenile angelshark (*Squatina squatina*) habitat in the Canary Islands with recommended measures for protection and management. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *30*(10), 2019–2025. https://doi.org/10.1002/aqc.3337

Jones, P. (2018). The long 'lost' history of bottom trawling in England, c. 1350–1650. *International Journal of Maritime History*, *30*(2), 201–217. https://doi.org/10.1177/0843871418766765

Kiger, M. E., & Varpio, L. (2020). Thematic analysis of qualitative data: AMEE guide no. 131. *Medical Teacher*, *42*(8), 846–854. https://doi.org/10.1080/0142159X.2020.1755030

Kittinger, J. N., McClenachan, L., Gedan, K. B., & Blight, L. K. (Eds.). (2015). *Marine historical ecology in conservation: Applying the past to manage for the future*. University of California Press.

Knauss, J. M. (2004). The growth of British fisheries during the industrial revolution. *Ocean Development & International Law*, *36*(1), 1–11. https://doi.org/10.1080/00908320490508912

Lawson, J. M., Pollom, R. A., Gordon, C. A., Barker, J., Meyers, E. K., Zidowitz, H., Ellis, J. R., Bartolí, Á., Morey, G., Fowler, S. L., & Alvarado, D. J. (2020). Extinction risk and conservation of critically endangered angel sharks in the eastern Atlantic and Mediterranean Sea. *ICES Journal of Marine Science*, *77*(1), 12–29. https://doi.org/10.1093/icesjms/fsz222

Marine and Coastal Access Act 2009. (2009). *Marine and Coastal Access Act 2009*. The Stationery Office.

Marine Management Organisation. (2021). *UK sea fisheries statistics 2021*. Marine Management Organisation.

Maritime and Coastguard Agency. (2012). *Code of practice for small commercial vessels operating in UK waters: Insurance, health and safety requirements*. Maritime and Coastguard Agency. https://www.gov.uk/operational-standards-for-small-vessels/codes-of-practice

Martin, C. S., Vaz, S., Ellis, J. R., Coppin, F., Le Roy, D., & Carpentier, A. (2010). Spatio-temporal patterns in demersal elasmobranchs from trawl surveys in the eastern English Channel (1988–2008). *Marine Ecology Progress Series*, *417*, 211–228. https://doi.org/10.3354/meps08802

Maxwell, J. A. (2012). *A realist approach for qualitative research*. Sage.

Mesnil, B., Cotter, J., Fryer, R. J., Needle, C. L., & Trenkel, V. M. (2009). A review of fishery-independent assessment models, and initial evaluation based on simulated data. *Aquatic Living Resources*, *22*(2), 207–216. https://doi.org/10.1051/alr/2009003

Meyers, E. K. M., Tuya, F., Barker, J., Jiménez Alvarado, D., Castro-Hernández, J. J., Haroun, R., & Rödder, D. (2017). Population structure, distribution and habitat use of the critically endangered angelshark, *Squatina squatina*, in the Canary Islands. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *27*(6), 1133–1144. https://doi.org/10.1002/aqc.2769

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.

Monkman, G., Cambie, G., Hyder, K., Armstrong, M., Roberts, A., & Kaiser, M. J. (2015). Socioeconomic and spatial review of recreational sea angling in Wales. *Fisheries and Conservation Report*, *52*, 176.

Moore, A. B. M., Brander, K., Evans, S., Holm, P., & Hiddink, J. G. (2024). Century-scale loss and change in the fishes and fisheries of a temperate marine ecosystem revealed by qualitative historical sources. *Fish and Fisheries*, *25*, 876–894. https://doi.org/10.1111/faf.12852

Moore, A. B. M., & Hiddink, J. G. (2022). Identifying critical habitat with archives: 275-year-old naturalist's notes provide high-resolution spatial evidence of long-term core habitat for a critically endangered shark. *Biological Conservation*, *272*, 109621. https://doi.org/10.1016/j.biocon.2022.109621

Mordue, T. (2009). Angling in modernity: A tour through society, nature and embodied passion. *Current Issues in Tourism*, *12*(5–6), 529–552. https://doi.org/10.1080/13683500903043244

Morey, G., Barker, J., Hood, A., Gordon, C., Bartolí, A., Meyers, E. K. M., Ellis, J., Sharp, R., Jimenez-Alvarado, D., & Pollom, R. (2019). *Squatina squatina*. The IUCN Red List of Threatened Species, 2019, pp.e-T39332A11749837.

Mundia, L. C. (2016). Participatory mapping framework and guidelines from a GIS perspective. *Environment and Ecology Research*, *4*(5), 280–287. https://doi.org/10.13189/eer.2016.040507

Myers, R. A., & Worm, B. (2003). Rapid worldwide depletion of predatory fish communities. *Nature*, *423*(6937), 280–283. https://doi.org/10.1038/nature01610

Newing, H., Eagle, C., Puri, R. K., & Watson, C. W. (2011). *Conducting research in conservation* (Vol. *775*). Routledge.

NVivo. (2020). *NVivo*. https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home

Ota, Y., & Just, R. (2008). Fleet sizes, fishing effort and the 'hidden' factors behind statistics: An anthropological study of small-scale fisheries in UK. *Marine Policy*, *32*(3), 301–308. https://doi.org/10.1016/j.marpol.2007.06.006

Ovando, D., Free, C. M., Jensen, O. P., & Hilborn, R. (2022). A history and evaluation of catch-only stock assessment models. *Fish and Fisheries*, *23*(3), 616–630. https://doi.org/10.1111/faf.12637

Owen, G. (1603). *The description of Penbrokshire*.

Pantin, J. R., Murray, L. G., Hinz, H., LeVay, L., & Kaiser, M. J. (2015). *The inshore fisheries of Wales: A study based on fishers' ecological knowledge*. Fisheries & Conservation Report No. 42.

Pedersen, M. W., & Berg, C. W. (2017). A stochastic surplus production model in continuous time. *Fish and Fisheries*, *18*(2), 226–243. https://doi.org/10.1111/faf.12174

Peirson, G., Tingley, D., Spurgeon, J., & Radford, A. (2001). Economic evaluation of inland fisheries in England and Wales. *Fisheries Management and Ecology*, *8*(4–5), 415–424. https://doi.org/10.1111/j.1365-2400.2001.00263.x

Pinnegar, J. K., & Engelhard, G. H. (2008). The 'shifting baseline' phenomenon: A global perspective. *Reviews in Fish Biology and Fisheries*, *18*(1), 1–16. https://doi.org/10.1007/s11160-007-9058-6

Pinto, C., Travers-Trolet, M., Macdonald, J. I., Rivot, E., & Vermard, Y. (2019). Combining multiple data sets to unravel the spatiotemporal dynamics of a data-limited fish stock. *Canadian Journal of Fisheries and Aquatic Sciences*, *76*(8), 1338–1349. https://doi.org/10.1139/cjfas-2018-0149

Pitcher, T. J., & Hollingworth, C. (Eds.). (2008). *Recreational fisheries: Ecological, economic and social evaluation*. John Wiley & Sons.

Robinson, L. A., & Frid, C. L. J. (2008). Historical marine ecology: Examining the role of fisheries in changes in North Sea benthos. *Ambio: A Journal of the Human Environment*, *37*(5), 362–372. https://doi.org/10.1579/07-A-300.1

Rogers, S. I., & Ellis, J. R. (2000). Changes in the demersal fish assemblages of British coastal waters during the 20th century. *ICES Journal of Marine Science*, *57*(4), 866–881. https://doi.org/10.1006/jmsc.2000.0574

Rufener, M. C., Kristensen, K., Nielsen, J. R., & Bastardie, F. (2021). Bridging the gap between commercial fisheries and survey data to model the spatiotemporal dynamics of marine species. *Ecological Applications*, *31*(8), e02453. https://doi.org/10.1002/eap.2453

Sea Fisheries Regulation Act. (1966). *c. 38*. https://www.legislation.gov.uk/ukpga/1966/38

Seafish. (2022). *Economics of the fishing fleet 2022*. https://www.seafish.org/document/?id=3265b28a-048a-4bd4-92d8-f37dd2949e2e

Sguotti, C., Lynam, C. P., García-Carreras, B., Ellis, J. R., & Engelhard, G. H. (2016). Distribution of skates and sharks in the North Sea: 112 years of change. *Global Change Biology*, *22*, 2729–2743. https://doi.org/10.1111/gcb.13316

Shorney, B. (2004). *Report commissioned by the Economics and Statistics Group of the Department for Environment, Food and Rural Affairs*. Defra.

Silva, J. F., & Ellis, J. R. (2019). Bycatch and discarding patterns of dogfish and sharks taken in English and Welsh commercial fisheries. *Journal of Fish Biology*, *94*(6), 966–980. https://doi.org/10.1111/jfb.13899

Silva, J. F., Ellis, J. R., & Catchpole, T. L. (2012). Species composition of skates (Rajidae) in commercial fisheries around the British Isles and their discarding patterns. *Journal of Fish Biology*, *80*(5), 1678–1703. https://doi.org/10.1111/j.1095-8649.2012.03247.x

Silvano, R. A. M., & Valbo-Jørgensen, J. (2008). Beyond fishermen's tales: Contributions of fishers' local ecological knowledge to fish ecology and fisheries management. *Environment, Development and Sustainability*, *10*(5), 657–675. https://doi.org/10.1007/s10668-008-9149-0

Simpfendorfer, C. A., Hueter, R. E., Bergman, U., & Connett, S. M. H. (2002). Results of a fishery-independent survey for pelagic sharks in the western North Atlantic, 1977–1994. *Fisheries Research*, *55*(1), 175–192. https://doi.org/10.1016/S0165-7836(01)00288-0

Squires, D., Campbell, H., Cunningham, S., Dewees, C., Grafton, R. Q., Herrick, S. F., Jr., Kirkley, J., Pascoe, S., Salvanes, K., Shallard, B., & Turris, B. (1998). Individual transferable quotas in multispecies fisheries. *Marine Policy*, *22*(2), 135–159. https://doi.org/10.1016/S0308-597X(97)00039-0

Stevens, J. D., Bonfil, R., Dulvy, N. K., & Walker, P. A. (2000). The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the

implications for marine ecosystems. *ICES Journal of Marine Science*, *57*(3), 476–494. https://doi.org/10.1006/jmsc.2000.0724

Terry, A., Lewis, K., & Bullimore, B. (2017). *Managing the inshore marine environment in the marine and coastal access act era: The Welsh experience*. UWE Bristol Research Repository.

Thurstan, R. H. (2022). The potential of historical ecology to aid understanding of human–ocean interactions throughout the Anthropocene. *Journal of Fish Biology*, *101*(2), 351–364. https://doi.org/10.1111/jfb.15000

Thurstan, R. H., Brockington, S., & Roberts, C. M. (2010). The effects of 118 years of industrial fishing on UK bottom trawl fisheries. *Nature Communications*, *1*(1), 15. https://doi.org/10.1038/ncomms1013

Thurstan, R. H., McClenachan, L., Crowder, L. B., Drew, J. A., Kittinger, J. N., Levin, P. S., Roberts, C. M., & Pandolfi, J. M. (2015). Filling historical data gaps to foster solutions in marine conservation. *Ocean and Coastal Management*, *115*, 31–40. https://doi.org/10.1016/j.ocecoaman.2015.04.019

Uberoi, E., Hutton, G., Ward, M., & Ares, E. (2021). *UK fisheries statistics*. Commons Library Research Briefing. Number CBP 2788.

Walker, P. A., & Heessen, H. J. L. (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

Walton, I., Cotton, C., & Swann, M. E. (2014). *The compleat angler* (Vol. *661*). Oxford University Press.

Whittamore, J. M., & McCarthy, I. D. (2005). The population biology of the thornback ray, Raja clavata in Caernarfon Bay, North Wales. *Journal of the Marine Biological Association of the United Kingdom*, *85*(5), 1089–1094. https://doi.org/10.1017/S0025315405012130

Williams, E., Byrne, R., & Scurlock, L. (2020). *The common fisheries policy and Wales after Brexit*. Welsh Parliament.

Winfield, I. J. (2016). Recreational fisheries in the UK: Natural capital, ecosystem services, threats, and management. *Fisheries Science*, *82*, 203–212. https://doi.org/10.1007/s12562-016-0967-y

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Data S1: Interview Guide for Fisher Engagement.

Data S2: Historical Timelines.

Data S3: Nautical Maps.

Data S4: Author Positionality Statements.

Data S5: Fisher Case Studies.

How to cite this article: Mason, F. C., Davies, J., Patel, S., Wray, B., Bartlett, C., Davies, M., Sharp, R., Worrall, C., Evans, J., O'Connor, J., Davies, S., Chamberlain, A., Pike, C., Whittey, K. E., Collins, C., Gollock, M., Barker, J., & Curnick, D. J. (2025). A fisher's perspective: Using half a century of local fisher knowledge to identify socio-economic, ecological and legislative trends influencing angelshark (*Squatina squatina*) records in Wales. *People and Nature*, *00*, 1–23. https://doi.org/10.1002/pan3.70044