Are critically endangered fish back on the menu? Analysis of U.K. fisheries data suggest post-ban landings of prohibited skates in European waters

Abstract

Skates (Rajidae) have been commercially exploited in Europe for hundreds of years with some species' abundances declining dramatically during the twentieth century. In 2009 it became "prohibited for EU vessels to target, retain, tranship or land" certain species in some ICES areas, including the critically endangered common skate and the endangered white skate. To examine compliance with skate bans the official UK landings data for 2011-2014 were analysed. Surprisingly, it was found that after the ban prohibited species were still reported landed in UK ports, including 9.6 tonnes of common skate during 2011-2014. The majority of reported landings of common and white skate were from northern UK waters and landed into northern UK ports. Although past landings could not be validated as being actual prohibited species, the landings' patterns found reflect known abundance distributions that suggest actual landings were made, rather than sporadic occurrence across ports that would be evident if landings were solely due to systematic misidentification or data entry errors. Nevertheless, misreporting and data entry errors could not be discounted as factors contributing to the recorded landings of prohibited species. These findings raise questions about the efficacy of current systems to police skate landings to ensure prohibited species remain protected. By identifying UK ports with the highest apparent landings of prohibited species and those still landing species grouped as 'skates and rays', these results may aid authorities in allocating limited resources more effectively to reduce landings, misreporting and data errors of prohibited species, and increase species-specific landing compliance.

Key words Fisheries; conservation; elasmobranch; overfishing; IUCN red list; Dipturus batis

1. Introduction

Humans have exploited fish for thousands of years [1] and have had a major impact on key species as well as their ecosystems [2-4]. Since the industrialisation of fishing in the late 19th and early 20th centuries, fishing has caused depletions of many species that have, in numerous cases, been masked by increasing catch efficiencies enabled by advances in technology, geographic expansion of fishing ranges and the exploitation of previously rejected species [5]. Prior to industrialised fisheries there appeared little or no need to collect catch data and to manage a longstanding traditional human food source, which at that time was thought to be inexhaustible [6, 7].

Despite anecdotal evidence suggesting a rapid increase in marine fishing *ca.*1000 A.D. in Europe, fisheries statistics were first collected about 110 years ago by the newly formed International Council for the Exploration of the Sea (ICES) [8]. With these data, investigations assessed the impact of fishing and were used to inform advice on sustainable levels of fishing for specific species. From these long-term records it has been documented for example that in England and Wales annual demersal fish landings from bottom trawl catches have significantly declined since the industrialisation of fishing in the 19th century [9].

On a global scale stock collapses due to overfishing have been well documented for some commercially important fish species, such as Atlantic cod in Canada [10] and Pacific anchovies [11], but many other marked declines in abundances of large fish species have gone largely unnoticed [12-15]. There are several examples of longstanding, unregulated exploitation of large fish leading to dramatic declines, particularly so among the elasmobranchs (sharks, skates and rays). Elasmobranchs have life-history characteristics that make them vulnerable to overfishing, including slow growth, late age at maturity and low fecundity, making them less resilient than bony fishes to overexploitation [16, 17]. According to the International Union for the Conservation of Nature (IUCN) Red List of threatened species, a quarter of all assessed sharks, skates and rays are thought to be ‘threatened’ due to overfishing. Of the seven most threatened families, five are skates and rays, with an increasing global catch of elasmobranchs now being made up of more skates and rays than sharks [16, 17].

In the north-east Atlantic Ocean and in the UK in particular, the main commercial interest for elasmobranchs is the family Rajidae (skates), of which there are 16 principal species. Prior to the expansion of marine fisheries in the 20th century, skates were of low value in the UK and were often rejected from fish markets [18]. However, by the beginning of the 1900s they became an increasingly important fishery, notably around the southern coast of England where they made up the highest quantity and value of any species group within the fishery [18, 19]. In the 1930s, during investigations of the catches of skates in fish markets in south-west England, it was noted that it was difficult to assess which species were of importance to the fishery because individuals were not landed as species but instead under the broad group 'skate and ray' [20]. Despite this early observation foreseeing the difficulties of accurate assessment without species data, it was not until 2009 that it became mandatory in European waters to land skates as species-specific groups rather than as 'skates and ray' [21]. During this period of increasing fishing pressure and unmonitored species catches (*ca*. 1900-2009), several species of skates declined in abundance. For example, in the late 19th century, common skate (*Dipturus batis*) were abundant in the waters around the UK and were caught throughout the year [22, 23]. By the 1920s there were reports that former areas of abundance in shallower coastal zones were now devoid of common skate [24], but during the 1930s fishermen were still landing significant quantities of *D. batis* from deeper waters [18]. However, by 1981 it was reported that *D. batis* had been extirpated from its former range due to overfishing. Indeed, records from > 800 trawls in the Irish Sea by the Ministry of Agriculture, Fisheries and Food (MAFF) in the 1970s showed no common skate were caught [12].

In addition to mandatory landing of 'skates and rays' by species after 2009, it became "*prohibited for EU vessels to fish for, to retain on board, to tranship or to land*" certain species in specific ICES areas. This protection includes common skate (*D. batis*) and white skate (*Rostroraja alba*) [21, 25] principally due to *D. batis* being IUCN Red List assessed as 'critically endangered', and the white skate *Rostroraja alba* as 'endangered'. Importantly, recent studies used morphometric and molecular genetic markers to demonstrate that there were cryptic species of common skate (*D. batis*), with two species in the north-east Atlantic having distinct but overlapping distributions [26, 27]. However, UK

landings data groups these two species (*D. batis* species-complex) into one 'common skate' group that will, in this study, be referred to as such. The undulate ray (*Raja undulata*) was also a prohibited species from 2009, however in 2015 the IUCN Red List assessment for European species downgraded its classification to 'near threatened' [28], essentially opening up the fishery for this species once more.

The Marine Management Organisation (MMO) and Marine Scotland are the authorities responsible for the enforcement of marine regulations including landing of restricted species in England and Wales, and in Scotland respectively. The MMO record data on the fish landings made at the ports, including both weight and value, which are collected from fishermen's log books and market sales notes. These agencies can also have representatives based at fish markets around the UK that inspect catches landed at market and those held in market cold stores. Data are then checked and verified by port staff as well as database managers and statisticians at the data input and archiving stages [29]. For data to support fisheries management measures reliably it is essential that landings and discard data are recorded accurately. This is especially important because landings data are widely used to inform and support the development and delivery of government decision-making at the UK and European level to enact components of the European Union Common Fisheries Policy. This includes contribution to stock assessment for estimation of total allowable catches (TACs), quota management, effort control and fleet management [29]. These data are also crucial to ongoing assessment of whether particular management policies are effective for sustainable exploitation of European fish stocks.

In a previous study the species composition of skates in UK commercial landings and discards was examined between 2007 and 2010, a period spanning the implementation of the bans [21]. The latter study concluded that reported landings of prohibited species had decreased after 2009, in line with conservation measures [21]. In the current study it was investigated whether the landings of prohibited skates have further declined toward zero, as would be expected if bans are being adhered to and are being policed effectively. Therefore, to investigate the effectiveness of the 2009 changes for skate landings in the UK with respect to prohibited species and the need for landings of species-specific

groups, data from 2011-2014 were obtained from the UK MMO for analysis. The expectation was that if the restrictions in place are effective, monitored and enforced, with sufficient resources available for error checking, data should be categorised as individual species and none of the prohibited species should appear in the data [30].

2. Method

Species-specific skate and ray data were obtained by written request from the UK MMO. The data were provided on 26th January 2015 and comprised data for UK flagged vessels landing into the UK and abroad, and foreign flagged vessels landing into the UK over the period from 2011 to 2014 inclusive. The data provided included landings of species in addition to the grouping 'skates and rays'. The dataset also included ICES area of capture, Food and Agriculture Organisation of the United Nations (FAO) area of capture, port where a landing was made and the live weight (metric tonnes) and value (£) of the landed catch. Live weight data were mapped in ArcGIS (10.2.2) according to ICES area and port. Relative quantities of common skate were also calculated to investigate whether higher landings of this species in northern ICES areas were a function of the higher overall landings from these areas. For each ICES area total common skate landings in 2014 were divided by the total skate and ray landings in 2014 for that respective ICES area. 'Skate and ray' landings by port were only mapped for ports when total landings were greater than 5 tonnes. The 2014 data were considered 'provisional' by the MMO at the time the analysis was undertaken.

3. Results

3.1 Prohibited species

Between 2011 and 2014, 9.6 tonnes of common skate (*D. batis*-species complex) were reported as landed all around the UK (Figure 1). There were higher landings in the north western and eastern ICES areas VIa (2.43 t; north-west Scotland) and IVb (1.89 t; central North Sea), respectively. Ports with particularly high total reports of landings of common skate were Scrabster (1.4 t), Mallaig (2.3 t), Peterhead (1.6 t), Oban (0.7 t), and Portavogie (0.7 t), all in Scotland, and Exmouth (0.6 t) in south-west England (Figure 2). Landings of common skate did not necessarily occur at all ports in every year. For example, Scrabster reported no landings in 2014 whereas Oban and Portavogie reported their highest landings of common skate in 2014 (0.4 t and 0.6 t respectively).

The general pattern of higher recorded landings of common skate from northern ICES areas, e.g. VIa north-west Scotland (Fig. 1), were not dependent on the higher overall landings of skates and rays made into northern UK ports. Rather, the landings of common skate from northern areas remained relatively higher than those from more southerly ICES areas even after accounting for the total skate and ray landings made from each area (Fig. 3). This pattern indicates landings of common skate were not distributed randomly around UK ports, but appeared to reflect latitudinal abundance differences.

The reported landings of white skate were 17.89 t in ICES area VIa (north-west Scotland), whereas in IVa (northern North Sea) the reported landings were higher at 29.49 t. In the latter area, however, it was not prohibited to fish for, retain or land white skate (Figure 4), indicating that the reported landings of white skate were of the same magnitude in weight irrespective of whether a ban for that species in that area was in place. In terms of ports, Mallaig (12.3 t) had relatively high quantities of prohibited landings of white skate, with lower numbers in other ports around the UK (Figure 5). Mallaig had its first year of zero reported landings of white skate in 2014, in contrast to Kinlochbervie in the same ICES area which had its highest reported landings in 2014 (0.5 t).

177 [Fig. 1 here]

178 [Fig. 2 here]

179 [Fig. 3 here]

180 [Fig. 4 here]

181 [Fig. 5 here]

182 **3.2 Other species**

183 Undulate ray (*R. undulata*) was also a prohibited species over the time period covered by the data.
184 Indeed, only minor landings of this species were reported in Newlyn in 2012 (1.6 kg), which likely
185 represented a single individual. The data also report some species landings which are not prohibited
186 but seem less reliable based on their species range. Data show that Arctic skate (*Amblyraja*
187 *hyperborea*) were landed off the southern coast of England between 2011 and 2014. The areas of note
188 are IVc (southern North Sea; 1.59 t), VIId (eastern English Channel; 0.13 t) and VIIe (western English
189 Channel; 0.13 t). Norwegian skate (*Dipturus nidarosiensis*) (1.1 kg), likely a single individual, was
190 reported landed in area VIId (eastern English Channel).

191 **3.3 Skates and rays**

192 Overall, the MMO landings data records that 769.6 tonnes of 'skates and rays' were landed as one
193 group between 2011 and 2014 in all areas of the UK (Figure 6). The amount of the former 'skates and
194 rays' group landed as species was 96% in 2014, with that remaining as 'skates and rays' amounting to
195 133 tonnes. The areas with the highest total landings during 2011-2014 were VIa (north-west
196 Scotland; 154.03 tonnes) and IVa (north-east Scotland; 287.60 t). For the 'skates and rays' landing
197 group, the highest landing ports were Peterhead (148.4 t) and Scrabster (163.4 t) followed by Lervick
198 (41.5 t), Lochinver (40.7 t) (all in Scotland), and Padstow (34.7 t) in south-west England (Figure 7).
199 For Padstow, the majority of this total (34.6 t) was landed in 2011, however since that time landings
200 ascribed to the 'skates and rays' group have been very low. For Scrabster, the highest landing port for
201 'skates and rays' landings have increased during the period, indeed almost doubling from 2011 (37.0
202 t) to 2014 (64.4 t). For the other ports mentioned here, all showed some decrease in this landing

group, although landings remained substantial. The lowest was Lochinver recording 1.6 tonnes in 2014.

[Fig. 6 here]

[Fig.7 here]

4. Discussion

This study reveals that prohibited skate species were recorded as landed all around the UK between 2011-2014 following the bans in 2009. The recorded landings were not distributed evenly, but instead, some areas and ports reported notably higher landings than others. Overall, the areas in the north of the UK reported higher landings of both common skate and white skate. Exmouth in the south also reported a relatively high number of common skate in the landings data (0.56 t between 2012 and 2014). These data indicate annual landings of prohibited species were still being made, or being recorded as made, across the UK at a time when bans for these species were in place within European waters. As well as the possibility that these may be actual landings of the prohibited skate species, there may also be factors that contribute to errors in reporting that mean these data may not represent actual landings. Therefore, three possible explanations are proposed for the occurrence of prohibited species in the UK landings statistics: (i) prohibited skate species were being caught, retained, landed and sold as the correctly named species; (ii) misidentification of skate species means no actual prohibited species were being caught, landed and sold; and, (iii) data entry errors at ports or elsewhere were occurring that mean no actual prohibited species were being caught, landed and sold. These principal possibilities are discussed in turn prior to making some conclusions based upon the available information presented here and that found elsewhere in the literature.

1. Are prohibited, endangered skates being landed into UK ports from fishing areas where bans are in place?

A recent study reported that the prohibited *D. batis*-species complex was recorded in both commercial and observer data as having been landed in the UK following capture in the central and northern North sea areas [21]. For example, the observer programme in the central and northern North Sea recorded 2.1 t of *D. batis*-complex being retained from the catch during 2010, after the 2009 ban was in place, a quantity that was higher than the 0.3 t reported as landed by the commercial otter trawl fleet from those areas in 2010. Our results confirm these prior landings by showing for the period 2011-2014 that common skate were still being recorded as landed by fishers after 2010 and that this

quantity appears to be not insignificant. This study found that 9.6 t of common skate were recorded landed in UK ports between 2011 and 2014. If an average-sized individual common skate is considered to be between 3.5 kg [27] and 33.17 kg [31] in total body mass, this estimates that between 289 and 2,743 individuals were landed (mean, 72-686 per year) in 2011-2014. Furthermore, it was evident that the apparent landing pattern was not random, with most recorded landings occurring in northern UK ports and caught within northern UK sea areas (see Figs 1 and 2). This pattern of catches and landings of common skate appears to be consistent with their currently known centres of abundance within their distributional range, which are thought to be greater in northern UK waters [26]. Clearly, this northern bias in common skate landings in 2011-2014 in the raw data may be a consequence of a higher number of skates generally being landed into northern ports as opposed to southern ones. However, even after accounting for the higher landings of skate species generally made from northern UK ICES areas, the current study still found the recorded landings of common skate to be relatively higher in the north of the UK (areas VIa, IVa and IVb), a pattern that would be expected if they were in higher abundance there (Figure 3). This implies that the recorded landings of common skate in 2011-2014 reflect the expected patterns of landings based on abundance and distribution. In support of this, common skate are occasionally reported from VIIa (Irish Sea), VIIf (Bristol Channel) and IVb (central North Sea), though it is suggested that its range is now limited to VIa (north-west Scotland) and the VIIh (Celtic Sea) [32]. That the relative landings of common skate reflect their reported latitudinal abundance trends argues against the pattern being largely due to misidentification of skates by fishers or officials, or due to erroneous data inputs occurring more often in northern areas, given that these types of errors should theoretically be equally likely in all areas and ports. Therefore, our results cannot entirely discount the possibility that common skate have actually been retained and landed into the UK in at least four of the years after 2009 when the ban came in force.

Despite these recorded landings in official data, there appears at present to be no evidence of common skate products entering the UK retail chain. Griffiths *et al* [33] analysed DNA sequences in tissue from 98 skate wings purchased in retail outlets, such as supermarkets and restaurants, but found no

evidence for the presence of prohibited or vulnerable skates for sale. This result may be a consequence of sample size however, since it may be expected that very few individuals of critically endangered species are likely to be sampled in markets or food outlets because they are naturally at low abundance and hence few are landed compared to other species. This assertion is supported by considering common skate numbers compared to total skate landed in 2014 for example, which estimates there would be a 0.054% chance of sampling a common skate, equivalent to finding one common skate for every 1,852 skates examined. Therefore, nearly two thousand individual skate would need to be tissue sampled for DNA before a single positive identification is likely statistically, even if they are entering the retail chain. Therefore, the possibility that common skate are entering the retail chain cannot be discounted on the basis of forensic studies undertaken to date.

2. **Are fishers misidentifying or misreporting prohibited skate species?**

Species misidentification is a major potential problem in skate fisheries that can contribute in important ways to confusion with interpreting prohibited species landings data. For instance, a recent study using molecular genetic markers found that in supermarkets where skate pectoral fins (marketed as 'skate wings') were labelled with a species name, 33% of the labels were incorrect [33]. Therefore, it seems misidentification of skate species occurs frequently and is being introduced somewhere along the retail chain from the point of skate capture to the location of sale to consumers. Of course, once the skate wings have been processed (skinned), it becomes much more difficult for retailers to identify the species correctly without molecular genetic analysis. Moreover, UK skate species are also difficult to identify even when alive. The spot pattern and/or colouration that is often used by fishers to distinguish between skate species can be highly variable within a species which enhances the problems of easy identification soon after capture [27]. The problem of persistent misidentification is well illustrated by two examples. One recent study [21] found significant discrepancies in the quantity of skate reported in commercial landings and that recorded by observers. In the North Sea in 2010 it was found that commercial otter trawlers reported 3.4 % of their skate catch as the spotted ray *Raja montagui*, whereas observers on otter trawlers in the same year reported that 50.9% was *R. montagui* [21]. In addition to that investigation, in this study the presence of Arctic and Norwegian

skate on the south coast of the UK in the landings data would also suggest ongoing issues with misidentification. Our investigation found recorded landings data supporting one or two individual Norwegian skate and a significant quantity of Arctic skate being 'landed' on the southern coast of England. However, the southern coast of England does not fall within the distributional range of these species, so it would seem highly unlikely that these species were in fact caught there or subsequently landed nearby. It is more likely that the individuals landed were misidentified or were incorrectly entered into the landings data. It is evident that correct identification is a significant and continuing problem in reporting landings.

Misidentification can take two forms. It could simply be unintentional error on the part of the fishers when faced with individuals from different species that look similar. This may happen frequently for more common species and remain undetected because the misidentifications are effectively lost among the large quantities of correctly identified individuals. However, equally, there may be intentional misidentification that manifests as misreporting. For example, at the fish market each of the main species of skate landed and traded (thornback ray *Raja clavata*; blonde ray, *R. brachyura*; spotted ray, *R. montagui*; cuckoo ray, *Leucoraja naevis*;and smalleyed ray, *R. microocellata*) has a separate price for species and for size class. Although prices fluctuate, blonde ray generally obtains the highest value, with thornback ray obtaining the lowest. Therefore, fishers may have an incentive to misreport a species for one most likely to obtain a higher price. Indeed, other studies have shown that misidentification has occurred purposefully in order to obtain a higher price or to hide the capture of a restricted species [34, 35]. The discrepancy in common skate reported as landed by fishers (0.3 t in 2010) and that recorded by observers as retained species (2.1 t in 2010) in the central and northern North Sea [21] could be explained by intentional misreporting of common skate as blonde ray, for example. However, this does not explain in the context of the current study why a fisher would record a common skate in the logbook of catches. It seems unlikely that a fisher would identify a common skate (rightly or wrongly), and regardless, attempt to land it for sale as common skate when a ban is known to be in operation for the species. Furthermore, the common skate is prohibited so there should in effect be no price for it, thus it would seem more likely that a fisher would log it as a different

species if their intention was to command a higher price. However, the recorded landings of common skate in 2011-2014 in this study were officially reported as having a monetary value of £10,456, implying that common skate were openly landed and sold as common skate unless of course these data were entirely incorrect (see section 3).

There is good reason to assume that misidentifications involving prohibited species should have a greater chance of being detected. It is not only the fishers that are involved in the process of catching fish right through to data collection and input by the management authorities, but there are other stages at which identification errors could be corrected. The fish merchants employ staff that sort and grade fish so that it can be priced according to species. The UK authoritative agencies also visit fish markets and cold stores to verify the catches. The skate are then sold to buyers that often prefer one species over another, because some species are easier to process than others, hence the higher price for blonde ray for example. There are then multiple steps with data cross checks and data validation that occur at the port with the fisheries' authorities and also their central database statisticians [29]. Given the number of steps involved from fish capture to identification and data entry, it is possible that apparent landings of prohibited species would most likely be checked and contraventions identified at the ports. Therefore, it seems unlikely that systematic misidentifications of a prohibited species, mainly in northern UK ports, can account for the relatively large quantities of these rare species appearing in official UK landings statistics.

3. **Are systematic errors in data input being made?**

Fishers input data into their log books, and in port the market agents then sort and grade species, as well as providing sales notes for the fish sold. The observers appointed by authoritative agencies inspect catches and enter the species they find onto data collection forms. There are many stages in this process where human error in data input could be introduced. Simply an incorrect box ticked could cause errors in allocations of landings to individual species. The entire chain from fishers to regulatory agencies' data input uses codes to identify each species. These codes are based on species scientific names, although the landings data uses common names. For example, RJB is the market

code for common skate *Dipturus batis*, however it is easy to appreciate that this may be confused with blonde ray *Raja brachyura*, whose code is actually RJH.

The scale of erroneous data entry appears to be significant. For example the MMO have reported that 80% of all electronic logs for fishing vessels in 2013 had to be amended due to incorrect information [29]. This only serves to indicate the large potential for error in data input that can be introduced from the very start of the data chain and right up to data transfer from fishers to fisheries managers. As part of data validation and review, statisticians also check for unlikely combinations of ICES area and species landing. However, the records found in this study after the data was provided to us on 26/01/2015 showing the occurrence of Arctic skate in ICES VIIe (western English Channel) in 2011 and 2012, suggests that likely errors are not being identified and corrected/deleted in a time frame that is relevant to management needs. For example, the 2011 data that held the likely errors noted above were still being sent to researchers in 2015. A previous study using recent UK landings data also questioned the accuracy of some of the commercial landings data, where skate species were apparently caught outside of their natural range [21].

Concluding Remarks

In the above discussion some of the data and arguments relevant to each possible cause of the reported landings of prohibited skate present in the UK official landings data has been set out. It was not possible to determine precisely which of the factors was largely responsible for the apparent illegal landings of protected species because there was no way to identify *post hoc* what actual species made up the landings reported. It is very likely that these three possible explanations are not mutually exclusive, making identifying the cause even more difficult. Nevertheless, there does appear to be support from this study and from a previous investigation [21] for the conclusion that common skate were landed and sold in UK ports after the 2009 ban. It is also possible that captured common skate were misidentified or misreported as being other skate species, while errors in allocating and recording market codes, and other data entry errors prior to finalising the official landings data may also play a significant role in misrepresenting landings of prohibited skate species.

382 Regardless of which of the three principal explanations was the most likely to account for prohibited
383 skate landings, there appears to be a lack of official investigation to determine the origin of the
384 apparent prohibited landings and to correct them where necessary. For example, this study was
385 provided with possible error-laden data by the regulatory authority some 3 years after it first appeared
386 in the UK official fish landings statistics. The persistence of erroneous data in official records may
387 reflect unequal resources available at ports across the UK for early detection of prohibited skate
388 landings, misidentifications, misreporting and data entry errors. Misreporting is more difficult to
389 identify generally in mixed catches of skates but should be possible with sufficient surveillance. The
390 UK spends significant public funds on the monitoring and enforcement of fisheries regulations, yet it
391 seems that some potential errors that can be straightforward to check are not only still occurring but
392 are remaining within the official statistics for at least three years.

393 There has been significant progress however in greater reporting of skate catches according to species
394 rather than the generic 'skates and rays' grouping. The current study supports the findings of Silva *et*
395 *al* [21], in that since the 2009 regulations were implemented improvements have been made in terms
396 of landing species-specific skates. Silva *et al* [21] report that in 2010, 92% were landed as species
397 specific. By the end of 2014 our analysis shows that this figure had risen to 96%. However, the 4%
398 that were not landed as species represent 133.3 tonnes of unknown species. Therefore it remains
399 possible that prohibited, endangered skates may make up some of this grouping.

400 Furthermore, there have been some improvements to reduce landings within the 'skates and rays'
401 group between 2011 and 2014 at certain ports, but such reductions are not consistent across the UK.
402 ICES areas and certain ports in northern Scotland appear to be relatively high in landing 'skates and
403 rays' grouped. Although it is possible that this could occur because of a lack of fisheries enforcement
404 offices in these more remote areas, it was evident that there are Marine Scotland compliance offices
405 based at all of the main ports including those with relatively high landings of prohibited species, such
406 as Mallaig, Scrabster and Fraserburgh. This suggests more needs to be done to enforce the landing of
407 skates in species-specific groups, not only to reduce the potential for prohibited species to be included

in landings of 'skates and rays', but to improve the accuracy of fisheries management advice for skate species.

In summary, this study draws attention to the recorded landings of prohibited skate species in each year from 2011-2014 since the European Union ban was put into effect in UK waters in 2009. That common skate have actually been openly landed and sold in UK ports since 2009 could not be entirely discounted. This possibility emphasises the need for greater efforts to enforce the ban across major UK fishing ports if these endangered species of fish are to be adequately protected according to the management measures put in place to safeguard their populations.

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