



Fossil heritage conservation in Scotland

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ABSTRACT

A globally significant palaeontological resource is an integral part of Scotland's geoheritage. A strong amateur collector tradition, extending back over two centuries, has helped fuel scientific advance with the fossil resource also supporting hobby collecting. However, during the long history of collecting activity, finite fossil resources have been under pressure with instances of large-scale collecting that has damaged some particularly vulnerable localities. Legislative provisions over recent decades offer robust site-based protection that will have safeguarded some of the best and most representative fossil localities. Additionally, the *Scottish Fossil Code*, the first national code of its type, has had a role in helping to raise awareness of Scotland's fossil heritage and engender its responsible collecting and subsequent care. The Code as designed appears to be working to an extent. However bespoke site management approaches are required for the most vulnerable localities with additional site safeguard measures being adopted where required. Care is being given to ensure that ongoing and potential future efforts to curb occasional instances of damaging collecting activity do not operate to the detriment of the amateur collector tradition and the encouragement of interest in palaeontology particularly in younger and future generations.

Keywords: Scottish Fossil Code, fossil collecting, amateur collector tradition, voluntary conservation, legislation.

RESUMEN

Una parte esencial del patrimonio de Escocia está constituido por recursos paleontológicos de importancia mundial. La fuerte tradición del coleccionismo por parte de aficionados, que se remonta a hace más de dos siglos, ha ayudado a impulsar el avance científico, al mismo tiempo que la presencia de fósiles ha favorecido esta afición. Sin embargo, durante la larga historia de la actividad de recolección, los recursos paleontológicos finitos han sido explotados, con casos de recolección a gran escala que han dañado algunas localidades particularmente vulnerables. Las disposiciones legislativas de las últimas décadas suponen una fuerte protección de los yacimientos, lo que ha permitido la salvaguarda de algunas de las mejores y más representativas localidades con fósiles. Además, el *Scottish Fossil Code*, el primer código nacional de su tipo, ha contribuido a aumentar la concienciación sobre el patrimonio paleontológico de Escocia y a promover tanto la recolección responsable como la posterior conservación. Tal y como está diseñado, el Código parece estar funcionando en cierta medida. Sin embargo, las localidades más vulnerables precisan enfoques particulares de gestión de yacimientos y medidas adicionales de conservación, en algunos casos que así lo requieren. Se está intentando garantizar que los esfuerzos actuales y futuros destinados a frenar los casos ocasionales de recolección inadecuada no vayan en detrimento de la tradición del coleccionismo por aficionados y del fomento del interés por la paleontología, especialmente para las generaciones más jóvenes y las futuras.

Palabras clave: Código de los Fósiles de Escocia, coleccionismo de fósiles, coleccionista amateur, conservación voluntaria, legislación.

1. A SIGNIFICANT FOSSIL RESOURCE WITH A CONTINUING ROLE AND VALUE

Scotland's rich and diverse geological heritage spans nearly three billion years of Earth's history (Trewin, 2002) of which its palaeontological resources are an integral part. Aspects of Scotland's palaeontology, particularly from the Palaeozoic and Jurassic, are unique and have been critical for the development of many fields in palaeontology (Clarkson, 1985). By means of example Scotland's Devonian fish and Carboniferous amphibian remains have played a key role in early vertebrate studies (Smithson *et al.*, 2012), (Fig. 1). The exquisitely preserved fossil terrestrial wetland ecosystem of the unique Rhynie-Windyfield Chert locality, a particularly significant Scottish Lagerstätte, has proved crucial in many respects including providing information on plant evolution and plant life cycles (Kenrick, 2017). Internationally significant finds, reflecting the variety and richness of fossils and their preservation in Scotland, are continually being made. This is exemplified by the recent discovery of tracksites within the Middle Jurassic sequences of Skye (de Polo *et al.*, 2018).

2. THE AMATEUR COLLECTING TRADITION

Scotland has had a strong tradition of amateur fossil collecting dating back to the 19th Century. Amateur collecting for research purposes on Devonian fossil fish is one such example (Andrews, 1982; Davidson, 2009) whereby amateurs, such as Robert Dick a baker from Thurso, worked in partnership with the specialists of the day such as Hugh Miller the famous 19th century fossil collector, geologist and author (Fig. 2). This amateur tradition continues to the present with amateurs continuing to have a role in both finding and researching fossil material to the ongoing benefit of palaeontological science (Fig. 3). The work of Newman *et al.* (2011) is exemplar in this regard.

Despite this tradition there is no data in Scotland on the level of collecting for the purposes of the simple enjoyment of discovering fossil material, with the building of private personal collections, and the profile of those that undertake it in terms of age and socio-economic circumstance. What is certain is that fossil collecting as a hobby pastime has been ongoing for a considerable period and continues



Figure 1. A fossil locality on the Whiteadder River in South-east Scotland, first identified by the fossil collector and dealer, Stanley P. Wood, now recognised as a globally significant resource of Lower Carboniferous tetrapod remains. A team of researchers, including specialists from the National Museums Scotland, are shown here investigating the site. © National Museums Scotland.



Figure 2. The Devonian fossil fish *Dipterus* from Achanarras Quarry SSSI, Caithness, North-east Scotland. A strong amateur tradition extending back over two centuries has facilitated research on these vertebrate fossils. © Nigel Trewin.

as evidenced by signs of collecting in the vicinity of fossiliferous horizons and perhaps given the market for geological excursion guides to well-known localities. Popular interest in fossils and fossil collecting, as a hobby enjoyed by a significant number of enthusiasts, may also be evidenced by popular books on the subject such as Delair (1966) and more recently Parker (2007). These promote the subject of palaeontology and provide advice on collecting procedure. The occurrence of websites in more recent

years, such as www.ukfossils.co.uk, promotes collecting with suggested locations where fossils may be found.

The value of hobby collecting to palaeontological research is that material is occasionally found, removed from palaeontological sites and subsequently handed to an appropriate institution. Research on Skye ichthyosaurs by Brusatte *et al.* (2015) was in part based on material found by a hobby collector that was donated to an accredited museum collection.



Figure 3. The 'Balruddery Fossil Team' at Balruddery Den, near Dundee, in 2006, consisting of researchers from Aberdeen University, staff from the National Museums Scotland, and amateur collectors and researchers. This work, which helped elucidate an early Devonian fish fauna, continues the amateur and professional working relationship that has been a feature of research at this locality, dating back to the 19th Century. © Bob Davidson.

3. THE ISSUE OF RESOURCE-DAMAGING COLLECTING

Open and accessible fossil-bearing sections, broken rock and fossils left behind at fossil localities provide indicators that a resource is receiving the attention of collectors. The point at which collecting becomes an issue of concern, at particularly important and well known classic sites that have a finite resource, is when large amounts of fossil-bearing material is removed from outcrop. There may also be evidence of heavy hand-held and industrial tools, including machinery, having been employed to extract rock and fossils therein (Fig. 4).

Damaging and irresponsible collecting has been an issue in Scotland since at least the 1960's (NCC, 1969, 1976). In the 1970's fossil fish localities in the vicinity of Lesmahagow, Lanarkshire, and on Orkney, were subjected to large-scale damaging collecting activity undertaken by collectors from Germany (Rolfe, 1977).

Matters became critical in the mid-1990's when the internationally significant Birk Knowes fossil fish locality sustained industrial-scale illegal collecting to the point that the level of the remaining resource remaining came into question. Fossil material was lost to science in private collections with some of it being sold to the Humboldt Museum, Berlin (MacFadyen, 2001). The efforts of Scottish Natural Heritage (SNH), the Scottish Government's nature conservation agency, to repatriate the fossil specimens in the care of the Humboldt were unsuccessful. However, the Birk Knowes case and other instances of illegal, irresponsible and damaging collecting did initiate calls for enhanced protection of palaeontological resources and the regulation of fossil collecting activity.

4. STATUTORY PROTECTION OF PALAEOLOGICAL RESOURCES

During the 1980's, 1990's and the first few years of the 21st century the best and most representative elements of the geological and palaeontological heritage of Scotland and Britain, were afforded statutory protection through designation as Sites of Special Scientific Interest (SSSI) under the 1981 Wildlife and Countryside Act (www.legislation.gov.uk/ukpga/1981/69/contents). Interestingly the legislation provided for the prosecution of landowners that damaged or removed fossil and other geological resources from their own land, if designated an SSSI, but did not provide for third party damage to the same resource. This meant that geological resources were vulnerable to damage by collectors, the only recourse available to address this being the landowner's ability and willingness to pursue the collectors for damage to, and theft of, their property. In Scotland that situation changed with the Nature Conservation (Scotland) Act 2004 (www.legislation.gov.uk/asp/2004/6/contents). This robust nature conservation legislation allowed for the prosecution of a third party who intentionally or 'recklessly' damages designated features of an SSSI including geological/palaeontological resources. In addition, rather than banning fossil collecting, the Scottish Government's response to perennial instances of damage to vulnerable fossil resources was to provide direction in the Act for SNH to prepare the *Scottish Fossil Code*. This voluntary Code would set out "recommendations, advice and information relating to fossils" and "promote awareness and understanding of it."



Figure 4. A sledge hammer, two mash hammers and a chisel representing a cache of tools left by a fossil collector at the Valtos SSSI on the Isle of Skye, North-west Scotland. Surrounded by broken rock, some of which also shows evidence of rocksaw usage, this is evidence of large-scale irresponsible fossil collecting that, in the context of the Nature Conservation (Scotland) Act 2004, may be described as 'reckless damage'. © Colin MacFadyen/Scottish Natural Heritage.

4.1. Scottish Fossil Code

In preparing the Code SNH constituted an external advisory team, known as the Fossil Code Working Group (FCWG), which consisted of fossil specialists, collectors (including a commercial fossil collector and dealer) and a landowner. The FCWG was consulted on the content and structure of the draft Code and contributed text. An extended Fossil Code Working Group comprising around 30 individuals and organisations was convened to advise on an initial draft of the Code. Responses received from these 'key consultees' directed the Code's further development resulting in the preparation of a draft Code for public consultation.

A full public consultation on the draft Code took place between 5th June and 7th September 2007 with the consultation launch event taking place at *Our Dynamic Earth* in Edinburgh. The event was the centrepiece of a campaign to inform as wide an audience as possible, who had an interest in Scotland's palaeontological heritage, that the consultation was underway inviting their say in how Scotland's fossils should be collected and looked after.

Following public consultation, the Scottish Fossil Code was completed and then launched on 11th April 2008 by the Scottish Government Environment Minister at Cromarty in North-east Scotland (Fig. 5). Cromarty was chosen as the location to announce the publication of the Code being the birthplace of Hugh Miller.

The Code (Fig. 6) provides advice on best practice in the collection, identification, conservation and storage of fossil specimens found in Scotland. The Code also aims to enhance public interest in the fossil heritage of Scotland and promote this resource for scientific, educational and recreational purposes. It was hoped then, and it is still the aspiration, that following the Code will increase the personal interest and satisfaction that can be gained from forming a fossil collection. The message conveyed at the launch of the Code was: "*If collecting fossils in Scotland, please do so responsibly and follow the advice on best practice in the collection and storage of fossil specimens outlined in the Scottish Fossil Code*". (The Code may be viewed and downloaded from: www.nature.scot/scottish-fossil-code).



Figure 5. The launch event for the Scottish Fossil Code in 2008, at Hugh Miller's birthplace of Cromarty, involved a Scottish Government Minister and the participation of students from the local primary school. The student holds a fossil of a *Diplacanthus crassisimus* which was found on Cromarty beach by Hugh Miller in circa 1839. © Scottish Natural Heritage.

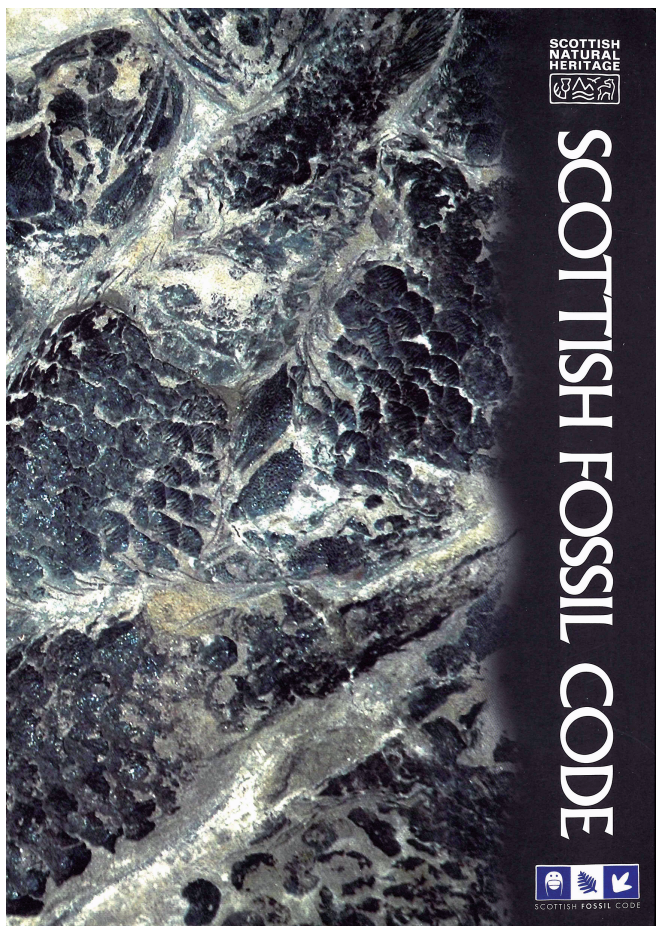


Figure 6. The Scottish Fossil Code. The Code, probably the first national code of its kind, provides best practice guidance in the collection, identification, conservation and storage of fossil specimens found in Scotland.

This message has persisted in Code promotional efforts together with the ‘essential elements’ of the Code, which are:

Seek permission - *In practice, common fossils and small geological specimens have traditionally been collected without permission and usually without hindrance. However, you are acting within the law if you obtain permission to extract, collect and retain fossils.*

Access responsibly - *Consult the Scottish Outdoor Access Code prior to accessing land. Be aware that there are restrictions on access and collecting at some locations protected by statute.*

Collect responsibly - *Exercise restraint in the amount collected and the equipment used. Be careful not to damage fossils and the fossil resource. Record details of both the location and the rocks from which fossils are collected.*

Seek advice - *If you find an exceptional or unusual fossil do not try to extract it; but seek advice from an expert. Also seek help to identify fossils or dispose of an old collection.*

Label and look after - *Collected specimens should be labelled and taken good care of.*

Donate - *If you are considering donating a fossil or collection choose an Accredited museum, or one local to the collection area.*

The Code was promoted widely in the UK by means of various publications with stakeholder groups that have an interest in the Scottish palaeontological resource being targeted directly. Efforts were also made to contact geological and palaeontological groups and societies in Germany and the Netherlands, with German, Dutch and Spanish language versions of key promotional material being made available on the SNH website.

5. REVIEW OF THE SCOTTISH FOSSIL CODE AND THE ADOPTION OF ANCILLARY MECHANISMS TO SAFEGUARD PALAEOONTOLOGICAL RESOURCES

Whilst being a ‘can do’ document that promotes responsible collecting, the fundamental intention of the Code was to help bring about an end to ‘reckless’ collecting. To determine a measure of success the 2004 Act also empowered SNH to review the Code and revise it if required (MacFadyen, 2011).

A review of the Code in 2012 (MacFadyen, 2012) revealed that it was well regarded nationally and internationally and was not deficient in the best practice guidance offered in the collection and care of fossil material. It indicated that fossil collecting was being undertaken more responsibly with fewer instances of large-scale and damaging activity taking place. Despite the encouraging findings it was clear there is either unwillingness or inability by collectors to seek permission from landowners to access land for the purpose of collecting which is the first ‘essential element’ of the Code. Therefore it may be argued that, by definition, irresponsible collecting was, and probably is, still widespread. Understandably, however, as has always been the case, a family group or young person keen on collecting fossil material is not necessarily resourced to ascertain who has legal title to the geological resources on an area of land.

Crucially a key measure of success centred on the number of instances of large-scale damaging collecting that occurred following the publication of the Code. These were fewer in number and not as severe as those that gave rise to the legal duty to prepare the Code. Notable examples include the large-scale extraction of Jurassic ammonites on Skye (MacFadyen, 2011, 2012) (Fig. 7), and Silurian fish in Lanarkshire (Kelly, 2017) (Fig. 8).



Figure 7. Discarded Jurassic ammonite fragments from Rigg to Bile SSSI on Skye, North-west Scotland. It would appear that only the rarest, largest and most complete specimens were collected and removed from the site. Indications suggest that this incident of damaging collecting activity was probably undertaken for commercial purposes. © Colin MacFadyen/Scottish Natural Heritage.



Figure 8. Shiel Burn SSSI, South Lanarkshire, Scotland, illustrating a void created through large-scale collector activity that resulted in the excavation of approximately a cubic metre of this well-known exposure of the Lower Silurian age Fish Bed Formation of the Hagshaw Hills Inlier. The figure in blue is located precisely at the point where the excavation took place. Although undertaken after publication of the Scottish Fossil Code such instances of large-scale damaging collecting are fewer in number. © Colin MacFadyen/Scottish Natural Heritage.

Remoteness of these locations was a primary factor in the failure to secure evidence, principally witness accounts, to enable utilisation of the powers in the Nature Conservation (Scotland) Act 2004 that could lead to prosecution of individuals responsible.

With the Code having a clear role and value in promoting responsible collecting and working to an extent, to curb ‘reckless’ collecting, the challenge in palaeontological resource management in Scotland has become the reduction of damaging instances still further. In the process of planning and undertaking that work there is the additional important and challenging issue of not, in the process, deterring and dissuading amateurs and young people from collecting.

The approaches adopted following the review of the Code, and continuing currently, are fourfold:

1. More effective and targeted promotion of the Code. Targeting types of collector that are most likely to be responsible for damage to finite vulnerable palaeontological resources to encourage responsible collecting behaviour aligned with the ethos of the Code. This is accompanied by a reminder that non-compliance and ‘reckless’ damaging collecting leaves them exposed to the possibility of prosecution.

2. Providing detailed, more specific, guidance for fossil resource owners. Opinion expressed that the Code is perhaps too overarching in its approach, to palaeontological heritage management, has been useful in bringing about better support for those that own and manage land which includes vulnerable and or finite fossil-bearing resources. For the owners of 25 such sites across Scotland detailed guidance has been produced on collector management that, if adhered to, could help curb irresponsible collecting by third parties.

3. Encouragement of voluntary conservation activity. Bringing about prosecutions for ‘reckless’ damage to palaeontological resources has so far been unsuccessful owing to the remoteness of sites. In an attempt to safeguard globally significant Middle Jurassic fossil resources on the Isle of Skye SNH instigated the ‘Safeguarding Skye’s Fossils’ campaign. This encourages the local community and visitors to the island to be on the lookout for irresponsible collecting activity and report it. It is hoped that residents local to important fossil localities may also be encouraged to adopt a voluntary warden role. A more positive side to this campaign requests that the local community, and visitors to the island, report fossil material that may be of particular scientific value to enable its conservation and research.

4. Nature Conservation Order. If all other mechanisms fail to curb damaging collecting at a site there is legislative provision available, in the form of the Nature Conservation Order (NCO), which may be employed. A NCO issued by Scottish Government Ministers can prohibit a particular identifiable activity such as the excavation and removal of geological resources. At the time of writing this is being investigated to augment the protection of highly vulnerable and rare, globally significant, vertebrate palaeontological resources on the Isle of Skye.

6. STRIKING A BALANCED APPROACH IN THE CONTROL AND REGULATION OF FOSSIL COLLECTING

Existing nature conservation legislation and the usefulness and effectiveness of additional measures in curbing irresponsible collector activity will in time be reviewed by SNH and the results considered by the Scottish Government. Given that the Code and ancillary protection mechanisms may not prevent occasional instances of ‘recklessly’ damaging collecting activity there may be calls for added legislative safeguards that extend beyond provisions in the Nature Conservation (Scotland) Act 2004. A universal ban on fossil collecting, for purposes other than research, could conceivably come into force that may effectively and significantly reduce instances of damaging

collecting. However, the impact on amateur collector activity and research would undoubtedly be detrimental to palaeontological science. Placing fossil material beyond the reach of amateurs and young people, and effectively ending hobby collecting could, for many, extinguish any interest in fossils, geology and natural history with the deleterious consequences that could have for education, geoconservation, science and the environment. Therefore, maximising the potential of existing legislative controls and voluntary devices and safeguards, and not further legislative regulation, is the likely future approach to fossil heritage conservation in Scotland.

7. CONCLUSIONS

The safeguard of the palaeontological resource in Scotland has a basis in fairly robust site-based legislative provisions. This was augmented in 2008 with the publication of the *Scottish Fossil Code* that promotes best practice guidance in the collection and care of fossil specimens. Evidence suggests that the Code has value and satisfies its intended function to a point but instances of irresponsible collecting occasionally occur. A variety of mechanisms may be employed to address this, including: targeted promotion of best practice guidance with the consequences of ‘recklessly damaging’ collecting being emphasised; working with owners providing them with detailed collector management guidance specific to their fossil resource; encouragement of voluntary conservation activity including site warden roles; and Nature Conservation Orders prohibiting collecting at particular sites if deemed essential.

The approach to the management of Scotland’s fossil resources has been fashioned in order to strike a balance between conserving the resource as a whole, for use by generations to come, with greater safeguards for the most vulnerable sites, whilst crucially, at the same time, ensuring that scientific research and an awareness and enjoyment of the fossil heritage continues. It is important that potential new students to palaeontology and geological science, amateur collectors and researchers, who can have a crucial function in specimen collecting and safeguard, are not deterred by overregulation and that the amateur collector tradition continues to thrive.

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