IUCN Conservation Outlook Assessment 2017 **(archived)**
Finalised on 09 November 2017

Please note: this is an archived Conservation Outlook Assessment for Miguasha National Park. To access the most up-to-date Conservation Outlook Assessment for this site, please visit https://www.worldheritageoutlook.iucn.org.

Miguasha National Park

SITE INFORMATION

Country:
Canada
Inscribed in: 1999
Criteria:
(viii)

Site description:
The palaeontological site of Miguasha National Park, in south-eastern Quebec on the southern coast of the Gaspé peninsula, is considered to be the world's most outstanding illustration of the Devonian Period known as the 'Age of Fishes'. Dating from 370 million years ago, the Upper Devonian Escuminac Formation represented here contains five of the six fossil fish groups associated with this period. Its significance stems from the discovery there of the highest number and best-preserved fossil specimens of the lobe-finned fishes that gave rise to the first four-legged, air-breathing terrestrial vertebrates – the tetrapods. © UNESCO

SUMMARY

2017 Conservation Outlook

Good

The conservation outlook for the Miguasha National Park is good and presents no immediate cause for concern. The current state of the geological values and attributes of the property is good and the trend is stable. New fossil discoveries are being made as a result of continuing field investigation, and an active research program is yielding new insights into the evolution of fishes and earl< tetrapods in Devonian times. The property is essentially secure and there are no significant near-term threats to its outstanding universal values or attributes. The current protection and management regime is very competent and effective. Over the longer term, the consequences of sea-level rise must be planned for.

Current state and trend of VALUES

Good
Trend: Stable

The current state of the geological values and attributes of the property is good and the trend is stable. New fossil discoveries are being made as a result of continuing field investigation, and an active research program is yielding new insights into the evolution of fishes and tetrapods in Devonian times. Fossil sites can be vulnerable to human- induced damage and loss, but this site is well protected and illegal activities are remarkably little reported. The site is not impacted by natural destructive events, although there is some concern about accelerated erosion of the cliff, which is being mitigated.

Overall THREATS

Very Low Threat

The property is secure and well protected. There are no immediate threats to its outstanding values or attributes. Some industrial developments were either suspended or are of no consequence for protection of the property. Concern

about erosion of the cliff has led to a program of monitoring and mitigation by re-forestation. A longer-term concern is that future sea level rise accompanying global warming will lead to inundation of the beach, increased coastal erosion, loss of fossils, and potential damage to infrastructure during the coming decades and centuries.

Overall PROTECTION and MANAGEMENT

Mostly Effective

Overall protection and management of the property can be rated as mostly or highly effective. There is a strong legal and administrative framework and effective management guided by a comprehensive legally binding management plan. Staff and financial resources are adequate for current needs.
However, there are some concerns as the administration has reduced the curatorial position from a full-time permanent position to a seasonal position (8 months per year).
The property is well supported by stakeholders in the local community and elsewhere. Interpretation facilities for visitors are of high standard, education outreach is good and the scientific research program is exemplary.

FULL ASSESSMENT

Description of values

Values

World Heritage values

► **Devonian age site with the highest number of best- preserved specimens of the lobe-finned fishes that gave rise to the world's first tetrapods**
Criterion:(viii)

The property is considered to be the world's most outstanding illustration of the "Age of Fishes", dating from the Devonian Period some 380 million years ago. Fossils of six of the eight groups of fishes known from this period are found here, and more than 18,000 fish specimens have been recovered. Of particular scientific importance is Eusthenopteron foordi, the study of which gave rise to the modern concept of evolution from fishes to terrestrial tetrapod vertebrates (the earliest amphibians). The discovery of the first complete specimen of another important lobe-finned fish Elpistostege watsoni in 2010 confirmed the crucial role of Miguasha in our understanding of the transition from fishes to tetrapods. The fossils are in exceptional condition, often allowing the study of soft body parts such as gill and muscle imprints, digestive tracks, blood vessels and cartilaginous elements of the skeleton (Cloutier, 2013; Sanchet et al. 2014). Another important discovery recently has been the larval and juvenile growth stages of many of the fishes, including the acanthodian Triazeugacanthus affinis (Cloutier et al., 2009; Cloutier, 2010b; Chevrinais et al., 2015a,b). The abundance of fossils with digestive content permitted to reconstruct the food web of this Devonian ecosystem. The additional presence of invertebrate, plant and spore fossils allows reconstruction of the Devonian ecosystem (Canada, 1999; IUCN, 1999; Chevrinais et al., 2015a,b, 2017; Cloutier, 2009, 2010a,

2011, 2013; Cloutier et al., 2011; Matton et al., 2012) such as the reconstruction of the trophic network of this Devonian paleocommunity because of the exceptional preservation of gut and stomach contents.

Assessment information

Threats

Current Threats

Very Low Threat

The property is essentially secure and well protected and lacks any significant or immediate threats. Some industrial developments outside the property have either been suspended or are of no consequence for protection of the property.

▶ **Industrial/ Military Effluents**

Very Low Threat
Outside site

A toxic waste incinerator was established in a neighboring province (New Brunswick) some 35 km from the property, without detrimental impact on the property (29COM 7B.17).

▶ **Oil/ Gas exploration/development**

Very Low Threat
Outside site

Reported exploratory drilling for oil and gas in the buffer zone was the subject of a monitoring mission in 2005 (29COM 7B.17; IUCN, 2005). The drilling, undertaken inadvertently in ignorance of the protection status of the land, was immediately suspended and there were no physical or visual impacts on the property. The government of Québec has since changed the status of the buffer zone to a State Reserve (Article 304 of the Quebec Mining Law M-13.1).

► Erosion and Siltation/ Deposition

Low Threat
Inside site, widespread(15-50%)
Outside site

Natural erosion of the cliff face by runoff, freezing and thawing, tides, waves, storms and less ice-covers during winter causes cliff retreat, affecting the community of organisms above the cliff and causing erosion and some loss of fossils. The natural retreat has been accelerated through de-forestation of the area behind the cliff face. Monitoring of the retreat of the cliff face started in 2009. The annual monitoring of three stations within the limits of the park (Laboratoire de Dynamique et de Gestion intégrée des Zones côtières, UQAR) shows retreat of 13-23 cm per year in average (2009-2016). Re-forestation of the area near the cliff were begun in 2012 (SEPAQ, 2017a, 2017b).

Potential Threats

Low Threat

Enhanced erosion caused by de-forestation, leading to loss of habitat behind the cliff and loss of fossils, is being monitored and mitigated by re-forestation.

► Temperature extremes

Very Low Threat
Inside site, throughout(>50%)

The site comprises a coastal cliff and beach. In the long term it and its infrastructure will be adversely affected by sea level rise associated with global atmospheric warming (WCMC, 2011).

Protection and management

Assessing Protection and Management

► Relationships with local people

Mostly Effective

Some 120 residents in the buffer zone are generally aware of the World Heritage status of the site and support it (Canada, 1999; IUCN, 1999).

▶ Legal framework

Highly Effective

Strong national and provincial legislation forms a basis for protection and management, including protection of the property in perpetuity, and a complete ban on mining in the property and buffer zone (Canada, 1999; IUCN, 1999). In 2004 the status of the buffer zone was changed to a State Reserve.

▶ Enforcement

Highly Effective

Enforcement of the relevant legislation is effective.

▶ Integration into regional and national planning systems

Mostly Effective

Parc National de Miguasha is part of Parcs Québec Network’s Ecological Integrity Monitoring Program (EIMP) (SEPAQ, 2014).

▶ Management system

Mostly Effective

There is a comprehensive management plan, which is prepared with public consultation and is legally binding on the site managers and the government.

▶ Management effectiveness

Mostly Effective

There is a good administrative and management framework and resources appear adequate for current management needs (Canada, 1999; IUCN, 1999; WCMC, 2011).However, there are some concerns as the administration has reduced the curatorial position from a full-time permanent position to a seasonal position (8 months per year). This reduction might impede the research and the accessibility to the collections (IUCN Consultation, 2017).

▶ Implementation of Committee decisions and recommendations

Mostly Effective

The Committee has raised matters regarding industrial drilling and toxic waste disposal outside the property, both of which have been satisfactorily addressed by the SP (29COM 7B.17).

▶ Boundaries

Mostly Effective

The park currently covers 87.3 hectares (0.8 km2). The Government of Quebec is responsible for the expansion projects, under OTC agreements with neighbouring landowners. The most recent acquisition took place in 2005 and this process of expansion will likely continue in the future (IUCN Consultation, 2017).

▶ Sustainable finance

Mostly Effective

The global budget of the site for 2017-2018 is $831 000 CAD. Visitors are currently charged an admission fee to the exhibits ($12.00 CAD) and the property ($8.50 CAD) of $20.50 CAD; it is free for person under 18 years of age.

▶ Staff training and development

Mostly Effective

One of the conservation coordinator is presently doing her PhD on the fossil fish from Miguasha. However a formal training opportunities program is not available to all staff members (IUCN Consultation, 2017).

▶ Sustainable use

Highly Effective

Visitation to the site, which represents the main use, appears to be sustainable. The property is one of the most significant paleontological research sites in the world.

► Education and interpretation programs

Mostly Effective

An excellent visitor centre has good interpretation facilities and programs, and there is an interactive program with schools (Canada, 1999; IUCN, 1999; WCMC, 2011; SEPAQ, 2017c).

► Tourism and visitation management

Mostly Effective

Numbers aremodest (15,000 to 17,000 person-days annually) and visitors are low-impact day-users only. There is no overnight accommodation or camping in the property. There is an excellent interpretation program and museum. Visitors are helpful in making new fossil discoveries and there is remarkably little reported illegal removal of fossils (WCMC, 2011).

► Monitoring

Highly Effective

Monitoring and surveillance programs are in place .

► Research

Highly Effective

There is a long history of research, by both domestic and international scientists, since fossils were first discovered here in 1842. More than 18.000 fish specimens have been collected and recorded in the site database, and many are exchanged with museums and other collections. Thousands of specimens are held in institutions elsewhere. The property is one of the most significant paleontological research sites in the world (Cloutier, 2009, 2010, 2013; Cloutier et al., 2011; Béchard et al., 2014; Chevrinais et al. 2017). Since 2000, strong collaboration and partnerships have been developed with the closest university, Université du Québec à Rimouski (UQAR). A formal partnership links the Parc national de Miguasha and UQAR since 2004.

Overall assessment of protection and management

Mostly Effective

Overall protection and management of the property can be rated as mostly or highly effective. There is a strong legal and administrative framework and effective management guided by a comprehensive legally binding management plan. Staff and financial resources are adequate for current needs.
However, there are some concerns as the administration has reduced the curatorial position from a full-time permanent position to a seasonal position (8 months per year).
The property is well supported by stakeholders in the local community and elsewhere. Interpretation facilities for visitors are of high standard, education outreach is good and the scientific research program is exemplary.

► **Assessment of the effectiveness of protection and management in addressing threats outside the site**

Highly Effective

Past threats from exploratory oil and gas drilling in the buffer zone have been removed without impacting the property (29COM B.17; IUCN, 2005).

State and trend of values

Assessing the current state and trend of values

World Heritage values

► **Devonian age site with the highest number of best- preserved specimens of the lobe-finned fishes that gave rise to the world’s first tetrapods**

Good
Trend:Stable

The current state of the fossil values and attributes of the property is good and the trend is stable. There are no significant concerns about their protection status. With ongoing field investigation and research new discoveries are being made (e.g., Chevrinais et al., 2017 a,b) and the property remains one of the most important paleontological sites in the world

(SOC report, 2005; WCMC, 2011; Cloutier 2009, 2010, 2013).

Summary of the Values

► **Assessment of the current state and trend of World Heritage values**

Good

Trend: Stable

The current state of the geological values and attributes of the property is good and the trend is stable. New fossil discoveries are being made as a result of continuing field investigation, and an active research program is yielding new insights into the evolution of fishes and tetrapods in Devonian times. Fossil sites can be vulnerable to human- induced damage and loss, but this site is well protected and illegal activities are remarkably little reported. The site is not impacted by natural destructive events, although there is some concern about accelerated erosion of the cliff, which is being mitigated.

Additional information

Benefits

Understanding Benefits

► **Importance for research**

The previous, ongoing, and potential future research on the fossils and the ancient environment at Miguasha are of major importance to scientific understanding of the Devonian Period. Research at Miguasha is of high quality and importance. Opportunities for research at Miguasha could be advertised more widely among the scientific community.

► **Contribution to education**

The property plays an important role in interpreting and educating students,

visitors, and the general public about the Devonian Period and the evolution of life on Earth.

This benefit depends on continued staffing for the educational and interpretive staff of the site.

Summary of benefits

The Miguasha National Park is a globally significant fossil locality for investigating and understanding the evolution of life on planet Earth, particularly the origins of terrestrial vertebrates, the tetrapods, from their fish ancestors during the Devonian Period. The site has yielded tens of thousands of fossil specimens, including exceptionally preserved skeletons along with larval and juvenile stages, many with details of soft-tissues preserved. The excellent museum, the educational programs, and the interpretive staff and volunteers are helping maximize the benefits from Miguasha in the wider community.

Projects

Compilation of active conservation projects

№	Organization/ individuals	Project duration	Brief description of Active Projects
1	Dr. Richard Cloutier (Université du Québec à Rimouski), Dr. John A. Long (Flinders University, Australia), Alice Clement (Flinders University, Australia), Isabelle Béchard, and graduate students at the Université du Québec à Rimouski		Anatomical, functional and phylogenetic studies of the closest relative to tetrapods, the elpistostegalian Elpistostege watsoni
2	Dr. Richard Cloutier (Université du Québec à Rimouski), Dr Zerina Johanson (Natural History Museum, London, UK) and parc national de Miguasha		Developmental studies of the placoderm Bothriolepis canadensis
3	Dr. Richard Cloutier (Université du Québec à Rimouski), Dr. Dominique Arsenault (Université du Québec à Rimouski), Dr. Alain Caron (Université du Québec à Rimouski) and parc national de Miguasha		Paleoecological investigation of the sedimentary setting d’of Elpistostege watsoni

№	Organization/ individuals	Project duration	Brief description of Active Projects
4	Dr. Marion Chevrinais, Dr. Richard Cloutier (Université du Québec à Rimouski) and Dr. Jean-Yves Sire (Université Sorbonne, France)		Study of the larval and juvenile developmental stages of the acanthodian fish Triazeugacanthus affinis.
5	Dr. Marion Chevrinais, Dr. Richard Cloutier (Université du Québec à Rimouski), Dr. Zerina Johanson (Natural History Museum, London, UK), Dr. John A. Long (Flinders University, Australia), Dr. Kate Trinajstic (Curtin University), Dr. Claude Renaud (Canadian Museum of Nature, Ottawa)		Analysis of the axial skeleton, pelvic girdle, and associated organs in the Devonian jawless vertebrate Euphanerops longaevus.
6	Dr. Robert Sansom, Dr. Sarah Gabbott (University of Leicester, UK)		Cranial and branchial anatomical investigation of the anapsid Euphanerops longaevus
7	Dr. David Legg (Oxford University, UK)		Dr. David Legg (Oxford University, UK)
8	Dr. Marion Chevrinais, Dr. Richard Cloutier (Université du Québec à Rimouski), Dr. Claire Jacquet (Université de Montpellier, France)		Paleoecological investigation of the Devonian Miguasha food web

REFERENCES

№	References
1	23COM VIIIA.1
2	29COM 7B.17
3	Béchard, I., Arsenault, F., Cloutier, R., and Kerr, J. 2014. 'The Devonian placoderm fish Bothriolepis canadensis revisited with three-dimensional digital imagery'. Palaeontologia Electronica 17.1.2a, 19 pp.
4	Canada, 1999. Miguasha National Park, Canada - World Heritage nomination file.
5	Chevrinais, M., Balan, E. and Cloutier, R. 2015b. New insights in the ontogeny and taphonomy of the Devonian acanthodian Triazeugacanthus affinis from the Miguasha Fossil-Lagerstatte, Eastern Canada. Minerals 6(1), 1, doi:10.3390/min6010001.
6	Chevrinais, M., Cloutier, R. and Sire, J.-Y. 2015a. 'The revival of a so-called rotten fish: the ontogeny of the Devonian acanthodian Triazeugacanthus'. Biology Letters 11:20140950. http://dx.doi.org/10.1098/rsbl.2014.0950.
7	Chevrinais, M., Cloutier, R. and Sire, J.-Y. 2015a. 'The revival of a so-called rotten fish: the ontogeny of the Devonian acanthodian Triazeugacanthus'. Biology Letters 11:20140950. http://dx.doi.org/10.1098/rsbl.2014.0950.
8	Chevrinais, M., Jacquet, C. & Cloutier, R. 2017a. 'Early establishment of vertebrate trophic interactions: Food web structure in two Middle-Late Devonian fish assemblages with exceptional fossilization'. Bulletin of Geoscience "Life in the Palaeozoic: an overview of land and sea ecosystems"
9	Chevrinais, M., Sire, J.-Y., and Cloutier, R. 2017b. 'From body scale ontogeny to species ontogeny: histological and morphological assessment of the Late Devonian acanthodian Triazeugacanthus affinis from Miguasha, Canada'. PLOS ONE 12(4):e0174655. https://doi.org/10.137/journal.pone.0174655.
10	Cloutier, R. 2009. Le Parc national de Miguasha. De l'eau à la terre. 2nd edition. Coll In Situ. Beauport, Publication MNH Inc.
11	Cloutier, R. 2010a. The Late Devonian biota of the Miguasha National Park UNESCO World Heritage site. GeoCanada: Working with the Earth, 2010, 4pp.

№	References
12	Cloutier, R. 2010b. The fossil record of fish ontogenies: Insights into developmental patterns and processes. Seminars in Cell and Developmental Biology, 21:400–413.
13	Cloutier, R. 2013. The Devonian Miguasha biota (Quebec): UNESCO World Heritage site and a time capsule in the early history of vertebrates. Geoscience Canada 40: 149-163.
14	Cloutier, R., I. Béchard, F. Charest & O. Matton 2009. La contribution des poissons fossiles du parc national de Miguasha à la biologie évolutive du développement. Le Naturaliste canadien, 133(3) : 84-95.
15	Cloutier, R., Proust, J.-N. and Tessier, B. 2011. The Miguasha Fossil-Fish-Lagerstätte: a consequence of the Devonian land-sea interactions. Palaeobiodiversity and Palaeoenvironments 91:293-323. https://doi.org/10.1007/s12549-011-0058-0.
16	IUCN, 2005. Report on monitoring mission to Miguasha World Heritage site, Quebec, Canada.
17	Matton, O., R. Cloutier & R. Stevenson 2012. Apatite for destruction: Isotopic and geochemical analyses of bioapatites and sediments from the Upper Devonian Escuminac Formation (Miguasha, Québec). Palaeogeography, Palaeoclimatology, Palaeoecology, 361–362:73–83
18	SEPAQ. (2017a). ‘The environmental indicators monitoring program at Parc National de Miguasha’. Parc National de Miguasha: Ecological Integrity. . Accessed 27 July 2017.
19	SEPAQ. (2017b). ‘Reforestation project launched to protect the fossil cliff’. Parc National de Miguasha: Orientations. . Accessed 27 July 2017.
20	SEPAQ. (2017c). ‘Activités Scolaires’. Parc National de Miguasha: Découvrir. < http://www.sepaq.com/pq/mig/decouvrir/scolaires.dot>;. Accessed 27 July 2017.
21	SOC report, 2005. Miguasha National Park, Canada.
22	Sanchez, S., Tafforeau, P. & Ahlberg, P. E. 2014. The humerus of Eusthenopteron: A puzzling organization presaging the establishment of tetrapod limb bone marrow. Proceedings of the Royal Society B-Biological Sciences 281.
23	WCMC, 2011. Miguasha National Park, Canada : Fact Sheet.