

Shark and ray life history

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As many of the world's shark and ray populations continue to decline (Dulvy *et al.* 2014) there is a growing need for improved conservation and management. One of the key requirements enabling design of effective conservation and management actions is life history parameters (Simpfendorfer *et al.* 2011) as these provide basic information on the dynamics of populations (Cortés 2007). Life history parameters (e.g. age, growth and reproduction) are directly tied to the reproductive output of a species, and thus unequivocally linked to the capacity of a population to withstand exploitation and to recover from decline. Despite this importance, research on the life history of sharks and rays has declined in recent years as 'cooler' and non-lethal topics have become more commonplace. However, on-going research on life history is fundamental for positive action to address declines of shark populations and policies aimed at recovery of populations. To highlight research that has been and is being conducted on the life history of sharks and rays, we have compiled a 'Shark and ray life history' virtual issue of *Marine and Freshwater Research* (Table 1), which is freely available from the Journal's website for a limited time (<http://www.publish.csiro.au/journals/mfr>).

The articles included in this virtual issue represent a broad spectrum of life history studies in terms of both species diversity (for both sharks and rays) and habitat diversity (from estuaries to the deep sea). Several of these studies represent the first records of life history parameters for a species, directly addressing the data that are lacking for many shark and ray species. The comparative nature of some of these studies, either between species or between locations, provides information vital for comprehensive understanding of species since life history traits may vary. Many of the studies are on commercially exploited species and provide information that will directly contribute to improved management of these species. Other studies are on less commonly caught species and contribute to the broader understanding of the ecology of sharks and rays and are valuable for the development of ecosystem-based management.

Life history research forms the basis for a broad range of other research that is important to the conservation and management of shark populations. It provides data inputs to stock assessments and ecological risk assessments, and forms the context for interpretation of genetic and behavioural studies. There is a critical need for ongoing life history research as data

Table 1. The 'Shark and ray life history' virtual issue of *Marine and Freshwater Research*

Title	Authors	Year	Volume	Issue	Pages	DOI
Age and growth of the great hammerhead shark, <i>Sphyrna mokarran</i> , in the north-western Atlantic Ocean and Gulf of Mexico	Andrew N. Piercy, John K. Carlson and Michelle S. Passerotti	2010	61	9	992–998	10.1071/MF09227
Diet and reproduction in the white-spotted eagle ray <i>Aetobatus narinari</i> from Queensland, Australia and the Penghu Islands, Taiwan	V. Schluessel, M. B. Bennett and S. P. Collin	2010	61	11	1278–1289	10.1071/MF09261
Age, growth and reproduction of a common deep-water shark, shortspine spurdog (<i>Squalus cf. mitsukurii</i>), from Hawaiian waters	Charles F. Cotton, R. Dean Grubbs, Toby S. Daly-Engel, Patrick D. Lynch and John A. Musick	2011	62	7	811–822	10.1071/MF10307
Similar life history traits in bull (<i>Carcharhinus leucas</i>) and pig-eye (<i>C. amboinensis</i>) sharks	Bree J. Tillett, Mark G. Meekan, Iain C. Field, Quan Hua and Corey J. A. Bradshaw	2011	62	7	850–860	10.1071/MF10271
Age, growth and maturity of the brown stingray (<i>Dasyatis lata</i>) around Oahu, Hawai'i	J. J. Dale and K. N. Holland	2012	63	6	475–484	10.1071/MF11231

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Title	Authors	Year	Volume	Issue	Pages	DOI
Comparative rates of growth of the Port Jackson shark throughout its southern Australian range	Christopher Izzo and Kate R. Rodda	2012	63	8	687–694	10.1071/MF11272
Life-history traits of a small-bodied coastal shark	Adrian N. Gutteridge, Charlie Huvneers, Lindsay J. Marshall, Ian R. Tibbetts and Mike B. Bennett	2013	64	1	54–65	10.1071/MF12140
Age, growth and reproductive biology of the spot-tail shark, <i>Carcharhinus sorrah</i> , and the Australian blacktip shark, <i>C. tilstoni</i> , from the Great Barrier Reef World Heritage Area, north-eastern Australia	Alastair V. Harry, Andrew J. Tobin and Colin A. Simpfendorfer	2013	64	4	277–293	10.1071/MF12142
Age, growth and reproductive biology of the rough skate, <i>Raja radula</i> (Chondrichthyes: Rajidae), off the Gulf of Gabes (southern Tunisia, central Mediterranean)	Hasna Kadri, Sondes Marouani, Mohamed Nejmeddine Bradai and Abderrahmen Bouain	2013	64	6	540–548	10.1071/MF12218
Validated age, growth and reproductive biology of <i>Carcharhinus melanopterus</i> , a widely distributed and exploited reef shark	Andrew Chin, Colin Simpfendorfer, Andrew Tobin and Michelle Heupel	2013	64	10	965–975	10.1071/MF13017
Maximum age and missing time in the vertebrae of sand tiger shark (<i>Carcharias taurus</i>): validated lifespan from bomb radiocarbon dating in the western North Atlantic and south-western Indian Oceans	M. S. Passerotti, A. H. Andrews, J. K. Carlson, S. P. Wintner, K. J. Goldman and L. J. Natanson	2014	65	8	674–687	10.1071/MF13214
Reproductive biology of the Magellan skate, <i>Bathyraja magellanica</i> (Chondrichthyes, Rajidae), in the south-western Atlantic	Lorena B. Scenna and Juan M. Díaz de Astarloa	2014	65	9	766–775	10.1071/MF13144
Regional differences in the reproductive parameters of the sparsely-spotted stingaree, <i>Urolophus paucimaculatus</i> , from south-eastern Australia	Fabian I. Trinnie, Terence I. Walker, Paul L. Jones and Laurie J. Laurenson	2014	65	11	943–958	10.1071/MF13275
Age and growth of the whale shark (<i>Rhincodon typus</i>) in the north-western Pacific	Hua Hsun Hsu, Shouou Jeng Joung, Robert E. Hueter and Kwang Ming Liu	2014	65	12	1145–1154	10.1071/MF13330

are lacking from the majority of shark and ray species. This research not only needs to document life history of poorly known species, but also develop techniques that address challenges of studying life history. These challenges include issues such as aging species with poorly calcified vertebrae (e.g. deepwater catsharks), enumerating the fecundity of oviparous species, and accounting for the under-estimation of age in older age-classes.

Marine and Freshwater Research has played a leading role in publishing articles describing research on sharks and rays and in dissemination of information expanding our knowledge of these animals. The ongoing commitment to publishing studies on life history of sharks and rays continues to provide an outlet for researchers skilled in this field and enables access to the highest quality science, which is continuously being used to improve conservation and management of members of this important and increasingly threatened group of aquatic predators.

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