

Supplementary Information for wedgefishes (Rhinidae) and giant guitarfishes (Glaucostegidae)

Generation lengths

There is a general lack of age and growth data for wedgefishes (Rhinidae) and giant guitarfishes (Glaucostegidae). Maximum age given by White *et al.* (2014) for female *Rhynchobatus* spp. (mixed samples of *R. australiae* and *R. palpebratus*) was 12 years. However, this figure alone is not useful to estimate generation length as White *et al.* (2014) did not provide female age at maturity, and the maximum age estimate was for a 183 cm total length (TL) individual, whereas *R. palpebratus* grows to 262 cm TL and *R. australiae* to ~300 cm TL (Last *et al.* 2016).

To provide a more realistic generation length estimate for large rhinid species as well as large glaucostegid species (those species reaching ≥ 200 cm TL), data can be used from White *et al.* (2014) for the Giant Guitarfish (*Glaucostegus typus*):

- Female age at maturity: 7 years (taken from the growth curve)
- Female maximum age: 19 years (for a 250 cm TL individual which is under but close to the maximum size of 270 cm TL; Last *et al.* 2016)
- Calculated generation length: 13 years
- Estimated generation length: 15 years (to account for the larger maximum size of the species compared with the largest individual aged)

For *Glaucostegus cemiculus*, Enajjar *et al.* (2012) found a female age at maturity of 5.1 years, and a maximum age of 14 years, which gives a generation length of 9.5 years. The largest specimen examined in this study was 198 cm TL, while the species reaches a maximum size of 265 cm TL; 9.5 years would therefore be an underestimate of generation length.

To ensure consistency across assessments, 15 years was applied as an estimated generation length to large (≥ 200 cm TL) rhinid and glaucostegid species, and 10 years was applied to smaller species (< 200 cm TL) (Table 1).

Table 1. Estimated generation lengths for wedgefishes (Rhinidae) and giant guitarfishes (Glaucostegidae).

Family	Species	Maximum Size (cm total length)	Estimated Generation Length (years)	Estimated 3 Generation Lengths (years)
Rhinidae	<i>Rhina ancylostoma</i>	270	15	45
Rhinidae	<i>Rhynchobatus australiae</i>	300	15	45
Rhinidae	<i>Rhynchobatus cooki</i>	81	10	30
Rhinidae	<i>Rhynchobatus djiddensis</i>	310	15	45
Rhinidae	<i>Rhynchobatus immaculatus</i>	99*	10	30
Rhinidae	<i>Rhynchobatus laevis</i>	200	15	45
Rhinidae	<i>Rhynchobatus luebberti</i>	300	15	45
Rhinidae	<i>Rhynchobatus palpebratus</i>	262	15	45
Rhinidae	<i>Rhynchobatus springeri</i>	213	15	45
Rhinidae	<i>Rhynchorhina mauritaniensis</i>	275	15	45
Glaucostegidae	<i>Glaucostegus cemiculus</i>	265	15	45
Glaucostegidae	<i>Glaucostegus granulatus</i>	229	15	45
Glaucostegidae	<i>Glaucostegus halavi</i>	187	10	30
Glaucostegidae	<i>Glaucostegus obtusus</i>	93	10	30
Glaucostegidae	<i>Glaucostegus thouin</i>	300	15	45
Glaucostegidae	<i>Glaucostegus typus</i>	270	15	45

*Immature male; maximum size suspected to be ~150 cm total length.

Population reduction calculations

Table 2. Proportional decline over 3 generation lengths (30–45 years) for wedgefishes and giant guitarfishes for Iran. Landings data are for the category 'giant guitarfish' which likely includes all rhinids and glaucostegids occurring locally, including Bowmouth Guitarfish (*Rhina ancylostoma*), Bottlenose Wedgefish (*Rhynchobatus australiae*), Whitespotted Wedgefish (*R. djiddensis*), Smoothnose Wedgefish (*R. laevis*), Sharpnose Guitarfish (*Glaucostegus granulatus*), and Halavi Guitarfish (*G. halavi*). Data source: FAO (2018).

	Year	Landings (t)	Year	Landings (t)
	1997	880	1997	880
	2016	295	2016	295
Proportional decline over 20 years	0.665		0.665	
Annual proportional change	0.947		0.947	
Generation length (years)	10		15	
3 generation lengths (3 GL; years)	30		45	
Proportion remaining	0.194		0.086	
Proportional decline over 3 GL	0.806		0.914	

Table 3. Proportional decline over 3 generation lengths (30–45 years) for wedgefishes and giant guitarfishes for Sindh, Pakistan. Landings data are for the category 'rhinobatid' which likely includes all rhinids, glaucostegids, and rhinobatids occurring locally, including Bowmouth Guitarfish (*Rhina ancylostoma*), Bottlenose Wedgefish (*Rhynchobatus australiae*), Smoothnose Wedgefish (*R. laevis*), Sharpnose Guitarfish (*Glaucostegus granulatus*), Halavi Guitarfish (*G. halavi*), and Widenose Guitarfish (*G. obtusus*). Data source: Mauvis Gore, unpublished data.

	Year	Landings (t)	Year	Landings (t)
	1999	902	1999	902
	2011	252	2011	252
Proportional decline over 13 years	0.720		0.720	
Annual proportional change	0.907		0.907	
Generation length (years)	10		15	
3 generation lengths (3 GL; years)	30		45	
Proportion remaining	0.053		0.012	
Proportional decline over 3 GL	0.947		0.988	

Table 4. Proportional decline over 3 generation lengths (30–45 years) for wedgefishes and giant guitarfishes for Balochistan, Pakistan. Landings data are for the category 'rhinobatid' which likely includes all rhinids, glaucostegids, and rhinobatids occurring locally, including Bowmouth Guitarfish (*Rhina ancylostoma*), Bottlenose Wedgefish (*Rhynchobatus australiae*), Smoothnose Wedgefish (*R. laevis*), Sharpnose Guitarfish (*Glaucostegus granulatus*), Halavi Guitarfish (*G. halavi*), and Widenose Guitarfish (*G. obtusus*). Data source: Mauvis Gore, unpublished data.

	Year	Landings (t)	Year	Landings (t)
	1994	921	1994	921
	2011	178	2011	178
Proportional decline over 18 years	0.806		0.806	
Annual proportional change	0.913		0.913	
Generation length (years)	10		15	
3 generation lengths (3 GL; years)	30		45	
Proportion remaining	0.065		0.016	
Proportional decline over 3 GL	0.935		0.984	

Table 5. Proportional decline over 3 generation lengths (30–45 years) for wedgefishes and giant guitarfishes for Maharashtra, India. Catch rate data are for myliobatoid rays (stingrays, eagle rays, butterfly rays, and devil rays) and while it does not include wedgefishes or giant guitarfishes, this can be used to infer declines given overlapping distributions, habitat, and susceptibility to capture in the same fishing gear. Data source: Raje and Zacharia (2009).

	Year	Catch rate (kg/hr)	Year	Catch rate (kg/hr)
	1990	0.65	1990	0.65
	2004	0.24	2004	0.24
Proportional decline over 15 years	0.631		0.631	
Annual proportional change	0.936		0.936	
Generation length (years)	10		15	
3 generation lengths (3 GL; years)	30		45	
Proportion remaining	0.136		0.050	
Proportional decline over 3 GL	0.864		0.950	

Table 6. Decline in landings of ‘guitarfishes’ from trawling in Chennai, Tamil Nadu, India. For rhinids, this grouping was reported to include Bowmouth Guitarfish (*Rhina ancylostoma*) and ‘*Rhynchobatus djiddensis*’. The latter does not occur in the area, and hence the grouping would therefore include local ‘whitespotted wedgefish’ species i.e. Bottlenose Wedgefish (*Rhynchobatus australiae*) and Smoothnose Wedgefish (*R. laevis*). For glaucostegids, this grouping was reported to include Sharpnose Guitarfish (*Glaucostegus granulatus*) and Widenose Guitarfish (*G. obtusus*) but was also likely to include Giant Guitarfish (*G. typus*) and Clubnose Guitarfish (*G. thouin*) which occur locally. Separate data were also provided for ‘*Rhynchobatus djiddensis*’, which would represent Bottlenose Wedgefish and Smoothnose Wedgefish. Data source: Mohanraj *et al.* (2009).

	‘Guitarfishes’		‘ <i>Rhynchobatus djiddensis</i> ’	
	Year	Landings (t)	Year	Landings (t)
	2002	278.7	2002	114.9
	2006	38.3	2006	14.9
Proportional decline over 3 GL	Dataset too short to reliably derive equivalent population reduction over three generations			

Table 7. Proportional decline over 3 generation lengths (30–45 years) for wedgefishes and giant guitarfishes for Indonesia. Landings data are for the category ‘whitespotted wedgefishes’ which likely includes all rhinids occurring locally including Bowmouth Guitarfish (*Rhina ancylostoma*), Bottlenose Wedgefish (*Rhynchobatus australiae*), Clown Wedgefish (*R. cooki*), Eyebrow Wedgefish (*R. palpebratus*), and Broadnose Wedgefish (*R. springeri*), and may also include glaucostegids (in any case, the trends can be considered representative of glaucostegids as well as rhinids). Data sources: DGCF (2015, 2017).

	Year	Landings (t)	Year	Landings (t)
	2005	28,492	2005	28,492
	2015	3,540	2015	3,540
Proportional decline over 11 years	0.876		0.876	
Annual proportional change	0.827		0.827	
Generation length (years)	10		15	
3 generation lengths (3 GL; years)	30		45	
Proportion remaining	0.003		0.0002	
Proportional decline over 3 GL	0.997		0.9998	

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