

## Intraspecific variability in diet and implied foraging ranges of whale sharks at Ningaloo Reef, Western Australia, from signature fatty acid analysis

Lara Marcus\*, Patti Virtue, Heidi R. Pethybridge, Mark G. Meekan, Michele Thums, Peter D. Nichols

\*Corresponding author: lmarcus@utas.edu.au

*Marine Ecology Progress Series 554: 115–128 (2016)*

### Supplement 1.

Table S1. Lipid content (mg g<sup>-1</sup> dm) and lipid class composition (% of total lipids ± standard error) for potential prey collected at Ningaloo Reef in May 2013, 2014 and 2015

Biochemical data		Fish larvae n = 19			Pelagic fish n = 3			Cephalopods n = 4		
		Mean	±	SE	Mean	±	SE	Mean	±	SE
Lipid content	mg.g <sup>-1</sup> dm	28.8	± 6.0		41.9	± 13.3		117.7	± 25.5	
Lipid class composition										
Wax esters	%	7.6	± 1.4		2.8	± 1.5		1.7	± 0.7	
Triacylglycerols	%	12.2	± 2.2		11.0	± 3.1		8.3	± 4.9	
Free fatty acids	%	12.2	± 3.5		5.4	± 3.5		4.6	± 0.9	
Sterols	%	6.5	± 0.8		5.5	± 1.5		13.8	± 2.9	
Phospholipids	%	57.0	± 4.5		75.4	± 6.0		71.6	± 5.3	

  

Biochemical data		Spratelloides n = 1			Crab larvae n = 7			Decapods n = 7		
		Mean	±	SE	Mean	±	SE	Mean	±	SE
Lipid content	mg.g <sup>-1</sup> dm	34.3	± -		115.1	± 36.2		80.4	± 43.7	
Lipid class composition										
Wax esters	%	2.1	± -		0.9	± 0.5		2.1	± 0.9	
Triacylglycerols	%	22.9	± -		72.7	± 9.3		5.2	± 2.2	
Free fatty acids	%	2.9	± -		1.9	± 0.3		3.3	± 1.0	
Sterols	%	7.8	± -		1.9	± 0.5		7.9	± 1.2	
Phospholipids	%	64.3	± -		22.6	± 8.9		82.1	± 3.3	

<b>Biochemical data</b>			<b>Myctophid n = 1</b>			<b>Isopods n = 2</b>			<b>Annelida n = 2</b>		
			<b>Mean</b>	<b>±</b>	<b>SE</b>	<b>Mean</b>	<b>±</b>	<b>SE</b>	<b>Mean</b>	<b>±</b>	<b>SE</b>
Lipid content	mg.g <sup>-1</sup>	dm	62.9	±	-	106.9	±	0.0	27.7	±	4.9
Lipid class composition											
Wax esters	%		1.7	±	-	7.6	±	0.7	9.6	±	3.5
Triacylglycerols	%		7.5	±	-	43.7	±	1.3	1.3	±	1.3
Free fatty acids	%		6.6	±	-	8.6	±	0.9	2.2	±	2.2
Sterols	%		12.4	±	-	2.5	±	0.2	11.1	±	0.0
Phospholipids	%		71.8	±	-	37.5	±	2.7	75.8	±	0.1

<b>Biochemical data</b>			<b>Sargassum n = 1</b>			<b>Larger Zooplankton n = 2</b>			<b>Krill n = 5</b>		
			<b>Mean</b>	<b>±</b>	<b>SE</b>	<b>Mean</b>	<b>±</b>	<b>SE</b>	<b>Mean</b>	<b>±</b>	<b>SE</b>
Lipid content	mg.g <sup>-1</sup>	dm	17.1	±	-	9.7	±	9.0	28.8	±	5.9
Lipid class composition											
Wax esters	%		2.2	±	-	8.8	±	8.8	2.2	±	1.0
Triacylglycerols	%		3.3	±	-	0.5	±	0.5	2.7	±	1.2
Free fatty acids	%		2.9	±	-	1.2	±	1.2	2.4	±	1.0
Sterols	%		6.4	±	-	15.0	±	5.5	10.4	±	0.9
Phospholipids	%		85.2	±	-	74.5	±	1.7	82.4	±	2.6

<b>Biochemical data</b>			<b>Mysids n = 7</b>			<b>Amphipods n = 2</b>		
			<b>Mean</b>	<b>±</b>	<b>SE</b>	<b>Mean</b>	<b>±</b>	<b>SE</b>
Lipid content	mg.g <sup>-1</sup>	dm	38.2	±	2.0	51.5	±	2.8
Lipid class composition								
Wax esters	%		3.9	±	1.4	3.9	±	2.8
Triacylglycerols	%		21.1	±	7.9	28.8	±	10.1
Free fatty acids	%		15.9	±	8.0	7.0	±	4.5
Sterols	%		9.9	±	1.6	7.5	±	0.4
Phospholipids	%		49.1	±	8.8	52.8	±	3.2

Table S2. The mean fatty acid composition (% of total FA  $\pm$  standard error) of the outer and inner layer of whale shark biopsies (n = 5) collected at Ningaloo Reef in May 2014

Fatty acid	Outer layer			Inner layer		
	n = 5			n = 5		
	Mean	$\pm$	SE	Mean	$\pm$	SE
14:0	0.2	$\pm$	0.1	0.1	$\pm$	0.0
15:0	0.2	$\pm$	0.0	0.1	$\pm$	0.0
16:0	10.0	$\pm$	1.2	7.4	$\pm$	1.8
i17:0	1.8	$\pm$	0.4	1.7	$\pm$	0.9
17:0	1.3	$\pm$	0.1	0.9	$\pm$	0.2
i18:0	0.8	$\pm$	0.1	0.6	$\pm$	0.1
18:0	18.5	$\pm$	0.8	18.3	$\pm$	3.6
20:0	0.4	$\pm$	0.1	0.5	$\pm$	0.1
22:0	0.6	$\pm$	0.1	0.4	$\pm$	0.1
24:0	0.4	$\pm$	0.2	0.4	$\pm$	0.2
<b>Total SFA</b>	<b>34.4</b>	$\pm$	<b>1.6</b>	<b>30.4</b>	$\pm$	<b>6.4</b>
16:1 $\omega$ 9c	0.4	$\pm$	0.1	0.1	$\pm$	0.0
16:1 $\omega$ 7c	1.1	$\pm$	0.2	1.4	$\pm$	0.7
16:1 $\omega$ 13t	0.2	$\pm$	0.0	0.2	$\pm$	0.1
17:1 $\omega$ 8c	1.2	$\pm$	0.1	1.3	$\pm$	0.5
17:1	2.9	$\pm$	0.3	2.3	$\pm$	0.6
18:1 $\omega$ 9c	11.9	$\pm$	2.7	13.5	$\pm$	3.0
18:1 $\omega$ 7c	7.2	$\pm$	3.1	5.6	$\pm$	2.4
18:1 $\omega$ 7t	0.1	$\pm$	0.0	0.8	$\pm$	0.7
18:1 $\omega$ 5c	0.1	$\pm$	0.0	0.2	$\pm$	0.1
20:1 $\omega$ 9c	1.2	$\pm$	0.2	2.6	$\pm$	1.4
20:1 $\omega$ 7c	0.3	$\pm$	0.1	0.3	$\pm$	0.0
20:1 $\omega$ 5c	0.2	$\pm$	0.0	0.3	$\pm$	0.1
22:1 $\omega$ 11c	0.4	$\pm$	0.2	0.5	$\pm$	0.4
22:1 $\omega$ 9c	0.3	$\pm$	0.1	2.8	$\pm$	2.2
22:1 $\omega$ 7c	0.3	$\pm$	0.0	0.3	$\pm$	0.2
24:1 $\omega$ 11c	0.2	$\pm$	0.1	0.4	$\pm$	0.2
24:1 $\omega$ 9c	1.7	$\pm$	0.1	1.5	$\pm$	0.3
<b>Total MUFA</b>	<b>29.7</b>	$\pm$	<b>1.0</b>	<b>34.2</b>	$\pm$	<b>5.4</b>
18:3 $\omega$ 6	0.2	$\pm$	0.0	0.1	$\pm$	0.1
18:4 $\omega$ 3	0.0	$\pm$	0.0	0.6	$\pm$	0.4
18:2 $\omega$ 6	0.9	$\pm$	0.1	0.6	$\pm$	0.2
18:3 $\omega$ 3	0.2	$\pm$	0.1	2.6	$\pm$	2.2
20:4 $\omega$ 6	17.1	$\pm$	1.4	14.0	$\pm$	3.6
20:5 $\omega$ 3	1.7	$\pm$	0.2	1.6	$\pm$	0.4
20:3 $\omega$ 6	0.4	$\pm$	0.1	0.4	$\pm$	0.1
20:4 $\omega$ 3	0.4	$\pm$	0.2	1.0	$\pm$	0.4
20:2 $\omega$ 6	0.2	$\pm$	0.0	0.3	$\pm$	0.0
21:5 $\omega$ 3	0.1	$\pm$	0.0	0.2	$\pm$	0.1
22:5 $\omega$ 6	1.2	$\pm$	0.2	1.8	$\pm$	0.5
22:6 $\omega$ 3	3.4	$\pm$	0.6	3.1	$\pm$	1.2
22:4 $\omega$ 6	6.6	$\pm$	0.6	6.7	$\pm$	2.0
22:5 $\omega$ 3	3.3	$\pm$	0.4	2.3	$\pm$	0.6
<b>Total PUFA</b>	<b>35.8</b>	$\pm$	<b>2.1</b>	<b>35.4</b>	$\pm$	<b>3.9</b>
Others	0.3	$\pm$	0.0	0.3	$\pm$	0.0

Others (<0.2%): i15:0, a15:0, i16:0, 14:1 $\omega$ 7c, 16:1 $\omega$ 7t, 16:1 $\omega$ 5c, 20:1 $\omega$ 11c

SFA: saturated fatty acids, MUFA: monounsaturated fatty acids, PUFA: polyunsaturated fatty acids

EPA: eicosapentanoic acid, DHA: docosahexaenoic acid, ARA: arachidonic acid

t: trans-configured MUFA, c: cis-configured MUFA

The suffix i denotes branched fatty acids from the iso-series. FALD: fatty aldehyde analysed as dimethyl acetal