

Age data of orange roughy
(*Hoplostethus atlanticus*) from the
southern Indian Ocean

Prepared for SIOFA

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Prepared by:
Richard Saunders

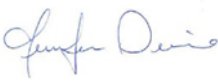


For any information regarding this report please contact:

Richard Saunders
Fisheries Scientist
Fisheries
+64-3-545 8876
Richard.Saunders@niwa.co.nz

National Institute of Water & Atmospheric Research Ltd
PO Box 893
Nelson 7040

Phone +64 3 548 1715

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	Reviewed by:	Jennifer Devine
	Formatting checked by:	Alex Quigley
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Executive summary

Otoliths of orange roughy (*Hoplostethus atlanticus*) from the southern Indian Ocean were prepared and aged for the Southern Indian Ocean Fisheries Agreement (SIOFA). Otoliths were selected and provided to NIWA for preparation and ageing by SIOFA. The otoliths were prepared and read by one reader following the accepted ageing protocol. The aim was to provide age data for a planned update of the growth curve in the southern Indian Ocean.

1 Introduction

The objective was the preparation and ageing of otoliths of orange roughy sampled from the southern Indian Ocean for the Southern Indian Ocean Fisheries Agreement (SIOFA). Otoliths were supplied and selected for ageing by the Southern Indian Ocean Fisheries Agreement (SIOFA). This is the second substantial set of age data produced for orange roughy from this area, the first being reported in Horn et al. (2018).

A protocol for ageing orange roughy was developed during an international workshop in 2007, and a formal documentation of this protocol was produced by Horn et al. (2016). The growth of juvenile orange roughy has been validated by examining the otolith marginal increment type and by length frequency analysis (Mace et al. 1990). Andrews et al. (2009) applied a lead-radium dating method to orange roughy and showed a reasonable correlation of the growth-zone counts to the expected lead-radium growth curve. This work provided support for both a centenarian life span for orange roughy and for the age estimation procedures using thin otolith sectioning (Horn et al. 2016).

2 Methods

Otoliths were supplied and selected for ageing by the Southern Indian Ocean Fisheries Agreement (SIOFA) from collections made by observers and/or a dedicated crew member on two Cook Islands flagged vessels fishing in the SIOFA area. Orange roughy otoliths were prepared using the method described in Horn et al. (2016). One whole otolith from each of the selected fish was individually embedded in resin and cured in an oven. A thin section was cut along a line from the primordium (otolith nucleus region) through the most uniform (and usually the longest) posterior-dorsal axis using a sectioning saw with dual diamond-impregnated wafering blades separated by a 380 μm spacer. The section was mounted on a glass microscope slide under a glass cover slip. When collected, some otoliths had been damaged such that the tips of the posterior-dorsal axes were missing on both otoliths. For some otoliths, however, it was possible to take sub-optimal, but complete, sections at other locations on the posterior-dorsal axis. For some sampled fish, both otoliths were too damaged or incomplete, and consequently neither otolith was prepared.

All otoliths were read once by one reader using the otolith interpretation and reading protocols described in the ageing methodology document (Horn et al. 2016). In addition, a reference set of 100 otoliths were read to provide estimates of precision and bias.

The data produced include counts of zones from the primordium to the transition zone (TZ), the zone that is considered to mark the onset of orange roughy maturity (Francis & Horn 1997), and from the TZ to the otolith margin. Also provided are readability codes for each of those readings provided on a 5-stage readability scale. Otolith data with a readability code of 5 (i.e., unreadable) for either the pre- or post-TZ readings were excluded. The presence of a TZ was identified, ideally, by the following three criteria: a clear reduction in zone width, a marked change in the optical density of the otolith from dark to light, and a change in curvature of the posterior arm of the otolith (Horn et al. 2016). TZs were classified using a 4-stage scale, i.e.:

- 0, not yet formed (or observed),
- 1, clear and unambiguous with all three criteria met,
- 2, a gradual transition with at least two criteria met,

- 3, a gradual transition with none or one of the criteria met.

For TZ classification 3, only a total age was recorded by the reader as the likely location of the TZ was undefined.

3 Results

Results from interpretation of the reference set indicated reasonable precision with a CV of 7.1%. There was no bias in interpretation.

A total of 356 otoliths were provided. Twenty-four of these were broken and unable to be sectioned. A total of 325 were able to be aged, with 7 sections that were unable to be interpreted (readability score 5).

Age estimates ranged from 19 to 183 years. Median age at the transition zone (i.e., age at maturity, see Francis & Horn (1997)) was 32 for males and 33 for females, but only 55% had identifiable transition zones (i.e. with a transition zone classification code of 1 or 2). Two obvious outliers were in the length-at-age plot, where fish under 35 cm were aged at 69 and 100 (Figure 1). These were re-aged and similar ages were produced; thus, the length information is likely inaccurate. We recommend these outliers be excluded when the data are used to generate a growth curve. The raw age data are presented in Appendix A.

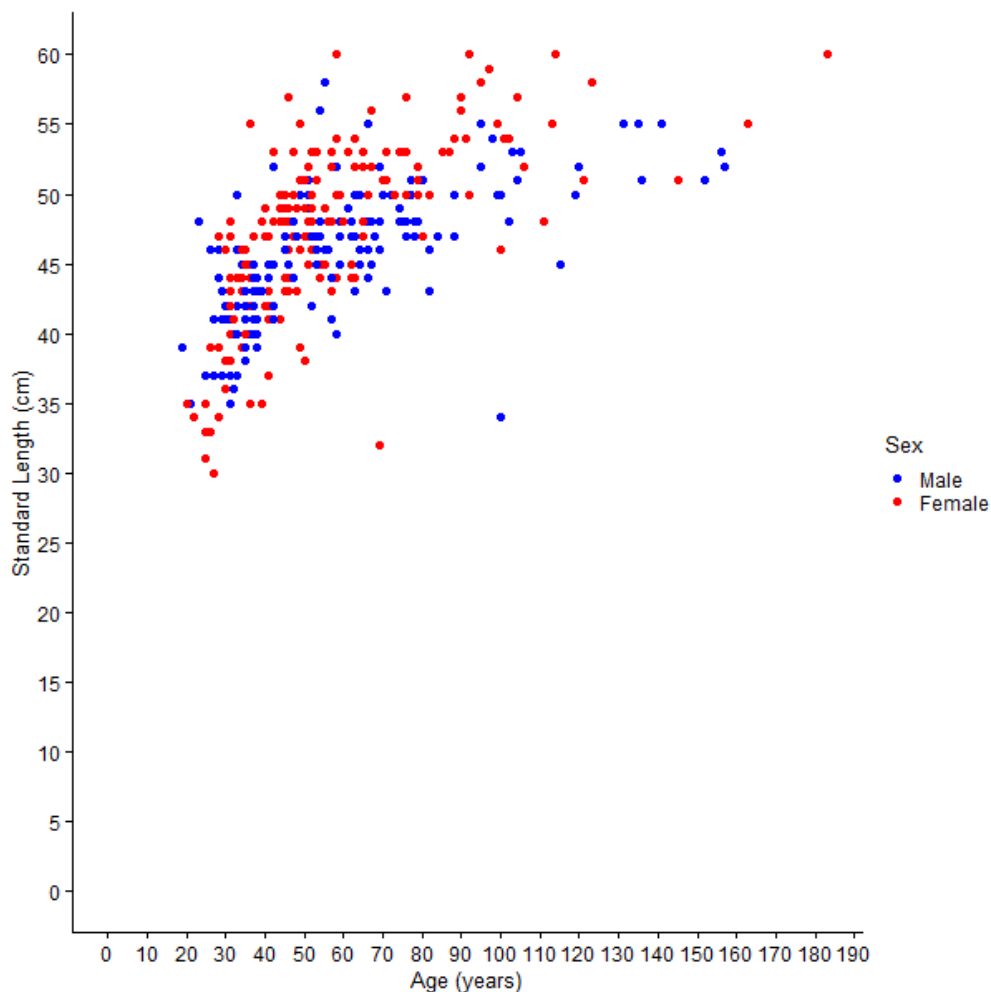


Figure 1: Length at age plot, differentiated by sex.

4 Discussion

The otolith structure differed to fish from New Zealand. They were far less likely to have an obvious transition zone. Specifically, they often lacked the curvature of the posterior arm of the otolith, which is an important feature to define the transition zone. This was also observed in Horn et al. (2018).

The otoliths were selected to provide additional data to improve the current growth curve for the southern Indian Ocean. As such, they are not representative of the population age frequency; however, it is noteworthy that substantial numbers of very old fish were in the sample provided.

The reference set utilised in this study is comprised of orange roughy sampled from the Tasman Sea and Pacific Ocean. If future ageing work is to be done on orange roughy in the southern Indian Ocean, we recommend developing a reference set specific to the area.

5 Acknowledgements

We thank the Cook Islands Ministry of Marine resources and their two fishing companies for collecting and providing the otoliths, Caoimhghin Ó Maolagáin for preparing the otoliths for ageing and Jennifer Devine for reviewing the manuscript. This work was funded by SIOFA and managed under NIWA project code SIO22401.

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Appendix A Age data

Table A-1: Data from all successfully aged otolith preparations. Origin, vessel where otoliths were collected; Prep_no, preparation number; Length, standard length in cm; 0-TZ, zone count from nucleus to TZ (or total zone count if TZR = 3); R1, readability of 0-TZ; TZR, transition zone classification; TZ-E, zone count from TZ to otolith edge; R2, readability of TZ-E; Total, fish age; Sex, sex of fish; oto_id, SIOFA provided otolith identification number.

Origin	Prep_no	0-TZ	R1	TZR	TZ-E	R2	Total	Length	Sex	oto_id
Cook Islands vessel 1	1	30	3	0			30	36	Female	4
Cook Islands vessel 1	2	41	3	3			41	37	Female	15
Cook Islands vessel 1	3	49	4	3			49	39	Female	17
Cook Islands vessel 1	4	63	3	3			63	44	Female	21
Cook Islands vessel 1	5							41	Female	35
Cook Islands vessel 1	6	55	3	3			55	45	Female	37
Cook Islands vessel 1	7	31	3	2	9	4	40	42	Female	37
Cook Islands vessel 1	8	51	3	3			51	45	Female	49
Cook Islands vessel 1	9	42	3	2	16	4	58	44	Female	12
Cook Islands vessel 1	10	37	4	2	84	4	121	51	Female	17
Cook Islands vessel 1	11	33	4	2	58	4	91	54	Female	50
Cook Islands vessel 1	12	33	4	2	80	4	113	55	Female	18
Cook Islands vessel 1	13	163	4	3			163	55	Female	43
Cook Islands vessel 1	14	28	4	2	51	4	79	52	Female	28
Cook Islands vessel 1	15	32	3	2	53	3	85	53	Female	49
Cook Islands vessel 1	16	39	4	2	49	4	88	54	Female	17
Cook Islands vessel 1	17	58	4	3			58	52	Female	4
Cook Islands vessel 1	18	33	4	2	54	4	87	53	Female	21
Cook Islands vessel 1	19	67	4	3			67	52	Female	22
Cook Islands vessel 1	20	34	4	2	15	4	49	51	Female	23
Cook Islands vessel 1	21	35	4	2	30	4	65	53	Female	24
Cook Islands vessel 1	22	26	4	2	32	4	58	54	Female	26
Cook Islands vessel 1	23	38	4	2	85	4	123	58	Female	3
Cook Islands vessel 1	24	39	4	2	51	4	90	56	Female	50
Cook Islands vessel 1	25	26	3	2	71	4	97	59	Female	19
Cook Islands vessel 1	26	34	3	1	61	4	95	58	Female	48
Cook Islands vessel 1	27	24	3	2	68	4	92	60	Female	27
Cook Islands vessel 1	28	46	3	3			46	57	Female	25
Cook Islands vessel 1	29	45	3	2	59	4	104	57	Female	47
Cook Islands vessel 1	30	28	4	2	48	4	76	57	Female	31
Cook Islands vessel 1	31	30	3	2	84	4	114	60	Female	50
Cook Islands vessel 1	32	29	3	0			29	37	Male	36
Cook Islands vessel 1	33	27	4	0			27	37	Male	38

Origin	Prep_no	0-TZ	R1	TZR	TZ-E	R2	Total	Length	Sex	oto_id
Cook Islands vessel 1	34	32	3	2	48	3	80	51	Male	2
Cook Islands vessel 1	35	33	3	2	38	4	71	53	Male	5
Cook Islands vessel 1	36	51	4	3			51	51	Male	6
Cook Islands vessel 1	37	95	4	3			95	55	Male	7
Cook Islands vessel 1	38	37	4	2	98	4	135	55	Male	13
Cook Islands vessel 1	39	35	3	2	68	4	103	53	Male	10
Cook Islands vessel 1	40	35	3	2	122	4	157	52	Male	11
Cook Islands vessel 1	41	33	3	2	123	4	156	53	Male	14
Cook Islands vessel 1	42	42	4	3			42	52	Male	9
Cook Islands vessel 1	43	58	4	3			58	52	Male	15
Cook Islands vessel 1	44	31	3	2	121	4	152	51	Male	12
Cook Islands vessel 1	45	35	3	2	63	4	98	54	Male	8
Cook Islands vessel 1	46	30	4	2	25	4	55	58	Male	8
Cook Islands vessel 1	47	54	3	3			54	56	Male	9
Cook Islands vessel 2	1	31	3	2	43	4	74	48	Male	46.120.9
Cook Islands vessel 2	2	28	3	2	60	4	88	50	Male	49.60.1
Cook Islands vessel 2	3	28	4	2	31	4	59	45	Male	49.60.3
Cook Islands vessel 2	4	46	4	3			46	45	Male	49.60.8
Cook Islands vessel 2	5	29	4	2	55	4	84	47	Male	49.60.9
Cook Islands vessel 2	6	28	4	2	33	3	61	49	Male	49.71.1
Cook Islands vessel 2	7	29	4	2	53	4	82	50	Female	49.71.10
Cook Islands vessel 2	8	28	4	2	74	4	102	54	Female	49.71.2
Cook Islands vessel 2	9		5					48	Female	49.71.3
Cook Islands vessel 2	10	30	4	2	17	4	47	47	Female	49.71.4
Cook Islands vessel 2	11	25	4	2	41	4	66	55	Male	49.71.5
Cook Islands vessel 2	12	66	4	3			66	46	Male	49.71.6
Cook Islands vessel 2	13	30	4	2	45	4	75	48	Male	49.71.7
Cook Islands vessel 2	14	29	4	2	25	4	54	44	Female	49.71.8
Cook Islands vessel 2	15	54	4	3			54	45	Female	49.60.10
Cook Islands vessel 2	16	28	3	1	36	4	64	50	Male	49.109.1
Cook Islands vessel 2	17	29	3	2	37	4	66	44	Male	49.109.2
Cook Islands vessel 2	18	32	3	2	19	4	51	49	Male	49.144.1
Cook Islands vessel 2	19	36	4	2	84	4	120	52	Male	49.144.2
Cook Islands vessel 2	20	31	3	2	24	4	55	49	Female	49.144.3
Cook Islands vessel 2	21	26	3	2	73	4	99	50	Male	49.144.4
Cook Islands vessel 2	22		5					48	Female	49.144.5
Cook Islands vessel 2	23	27	4	2	37	3	64	46	Male	49.144.6
Cook Islands vessel 2	24	38	4	3			38	40	Male	49.144.7
Cook Islands vessel 2	25	24	3	2	35	4	59	48	Male	49.144.8

Origin	Prep_no	0-TZ	R1	TZR	TZ-E	R2	Total	Length	Sex	oto_id
Cook Islands vessel 2	26	42	4	3			42	45	Male	49.144.10
Cook Islands vessel 2	27	30	3	2	28	4	58	60	Female	49.159.1
Cook Islands vessel 2	28	31	4	2	22	4	53	46	Female	49.159.5
Cook Islands vessel 2	29	30	4	2	71	4	101	54	Female	49.159.6
Cook Islands vessel 2	30	40	4	2	22	4	62	48	Male	49.159.7
Cook Islands vessel 2	31	37	4	2	28	4	65	52	Female	49.159.8
Cook Islands vessel 2	32	33	4	2	44	4	77	51	Male	49.159.9
Cook Islands vessel 2	33	32	3	2	45	4	77	50	Male	49.227.1
Cook Islands vessel 2	34	99	4	3			99	55	Female	49.227.6
Cook Islands vessel 2	35	34	4	2	97	4	131	55	Male	49.227.7
Cook Islands vessel 2	36	28	3	2	25	4	53	47	Male	49.227.8
Cook Islands vessel 2	37	79	3	3			79	51	Female	49.284.2
Cook Islands vessel 2	38	29	4	2	46	4	75	53	Female	49.284.6
Cook Islands vessel 2	39	36	0				36	45	Female	49.284.7
Cook Islands vessel 2	40	38	3	2	68	4	106	52	Female	49.350.1
Cook Islands vessel 2	41	39	4	2	20	4	59	50	Female	49.350.2
Cook Islands vessel 2	42	35	4	2	6	4	41	41	Male	49.350.4
Cook Islands vessel 2	43	53	3	3			53	53	Female	49.350.8
Cook Islands vessel 2	44	55	4	3			55	46	Female	49.350.9
Cook Islands vessel 2	45	51	4	3			51	50	Male	49.350.10
Cook Islands vessel 2	46	45	4	3			45	49	Female	49.352.1
Cook Islands vessel 2	47	35	4	2	41	4	76	48	Male	49.352.4
Cook Islands vessel 2	48	37	4	3			37	47	Female	49.352.5
Cook Islands vessel 2	49	31	4	2	36	4	67	56	Female	49.352.7
Cook Islands vessel 2	50	33	4	3			33	46	Male	49.352.8
Cook Islands vessel 2	51	26	3	2	29	4	55	49	Female	49.352.10
Cook Islands vessel 2	52	37	4	2	42	4	79	50	Female	50.127.1
Cook Islands vessel 2	53	39	4	3			39	48	Female	50.127.2
Cook Islands vessel 2	54	36	3	3			36	35	Female	50.127.6
Cook Islands vessel 2	55	33	4	2	?	5		50	Male	50.127.10
Cook Islands vessel 2	56	41	3	0			41	47	Female	50.133.1
Cook Islands vessel 2	57	37	3	0			37	43	Male	50.133.2
Cook Islands vessel 2	58	34	4	2	16	4	50	47	Female	50.133.5
Cook Islands vessel 2	59	46	4	3			46	44	Female	50.133.6
Cook Islands vessel 2	60	48	4	3			48	49	Female	50.133.8
Cook Islands vessel 2	61	44	4	3			44	50	Female	50.133.9
Cook Islands vessel 2	62	32	3	2	16	4	48	43	Female	50.133.10
Cook Islands vessel 2	63	30	3	2	33	4	63	47	Male	50.135.2
Cook Islands vessel 2	64	31	4	0			31	40	Female	50.135.3

Origin	Prep_no	0-TZ	R1	TZR	TZ-E	R2	Total	Length	Sex	oto_id
Cook Islands vessel 2	65	37	4	3			37	45	Male	50.135.5
Cook Islands vessel 2	66	49	4	3			49	50	Male	50.135.9
Cook Islands vessel 2	67	33	4	2	67	4	100	46	Female	50.135.10
Cook Islands vessel 2	68	40	4	3			40	49	Female	50.171.1
Cook Islands vessel 2	69	76	4	3			76	53	Female	50.127.3
Cook Islands vessel 2	70	52	4	3			52	53	Female	50.171.3
Cook Islands vessel 2	71	33	3	0			33	42	Male	50.171.4
Cook Islands vessel 2	72	31	4	0			31	47	Female	50.171.8
Cook Islands vessel 2	73	27	3	2	21	4	48	47	Male	50.127.9
Cook Islands vessel 2	74	28	3	0			28	47	Female	50.172.1
Cook Islands vessel 2	75	32	3	2	29	4	61	53	Female	50.172.4
Cook Islands vessel 2	76	66	3	3			66	50	Female	50.172.5
Cook Islands vessel 2	77	32	3	2	30	3	62	45	Female	50.172.7
Cook Islands vessel 2	78	31	3	2	59	4	90	57	Female	50.172.9
Cook Islands vessel 2	79	35	3	0			35	38	Male	50.208.1
Cook Islands vessel 2	80	34	4	0			34	45	Male	50.208.2
Cook Islands vessel 2	81	21	3	0			21	35	Male	50.208.3
Cook Islands vessel 2	82	28	4	0			28	44	Male	50.208.4
Cook Islands vessel 2	83	35	4	0			35	42	Male	50.208.5
Cook Islands vessel 2	84	32	3	1	13	4	45	47	Male	50.208.6
Cook Islands vessel 2	85	32	4	3			32	40	Male	50.208.7
Cook Islands vessel 2	86	33	2	0			33	40	Male	50.208.8
Cook Islands vessel 2	87	26	3	2	15	4	41	44	Male	50.208.9
Cook Islands vessel 2	88	25	3	0			25	37	Male	50.208.10
Cook Islands vessel 2	89	30	3	0			30	38	Female	51.1.1
Cook Islands vessel 2	90	29	3	2	66	4	95	52	Male	51.1.2
Cook Islands vessel 2	91	27	3	2	28	4	55	46	Male	51.1.3
Cook Islands vessel 2	92	38	3	3	24	3	62	47	Male	51.1.4
Cook Islands vessel 2	93	59	3	3			59	48	Male	51.1.9
Cook Islands vessel 2	94	23	3	2	34	4	57	48	Male	51.1.10
Cook Islands vessel 2	95	27	3	1	9	3	36	44	Female	51.7.1
Cook Islands vessel 2	96	27	3	2	29	4	56	48	Male	51.7.2
Cook Islands vessel 2	97	33	3	2	43	4	76	47	Male	51.7.5
Cook Islands vessel 2	98	71	4	3			71	53	Female	51.7.7
Cook Islands vessel 2	99	63	4	3			63	54	Female	51.7.10
Cook Islands vessel 2	100	25	3	2	44	4	69	48	Male	53.6.1
Cook Islands vessel 2	101	53	4	3			53	47	Male	53.6.2
Cook Islands vessel 2	102	28	3	2	35	4	63	50	Male	53.16.2
Cook Islands vessel 2	103	35	4	0			35	46	Female	53.16.3

Origin	Prep_no	0-TZ	R1	TZR	TZ-E	R2	Total	Length	Sex	oto_id
Cook Islands vessel 2	104	37	4	2	17	3	54	48	Female	53.16.4
Cook Islands vessel 2	105	31	4	2	25	3	56	48	Female	53.16.5
Cook Islands vessel 2	106	28	3	1	24	3	52	50	Female	53.16.7
Cook Islands vessel 2	107	34	4	2	16	4	50	49	Female	53.16.8
Cook Islands vessel 2	108	31	4	2	48	4	79	48	Male	53.32.1
Cook Islands vessel 2	109	34	4	2	19		53	45	Male	53.32.2
Cook Islands vessel 2	110	27	3	2	47	3	74	49	Male	53.32.3
Cook Islands vessel 2	111	32	3	2	109	4	141	55	Male	53.32.5
Cook Islands vessel 2	112	31	3	2	32	4	63	52	Female	53.32.6
Cook Islands vessel 2	113	25	3	2	23	4	48	49	Female	53.32.8
Cook Islands vessel 2	114	38	3	0			38	43	Male	53.32.10
Cook Islands vessel 2	115	32	4	2	37	3	69	32	Female	53.45.1
Cook Islands vessel 2	116	36	4	2	68	4	104	51	Male	53.45.2
Cook Islands vessel 2	117	39	4	3	39	4	78	47	Male	53.45.3
Cook Islands vessel 2	118	27	4	2	38	4	65	47	Female	53.45.4
Cook Islands vessel 2	119	33	3	0			33	44	Female	53.45.6
Cook Islands vessel 2	120	29	3	2	25	4	54	48	Male	53.45.7
Cook Islands vessel 2	121	71	3	3			71	51	Female	53.45.8
Cook Islands vessel 2	122		5					48	Female	53.45.9
Cook Islands vessel 2	123	30	3	2	15	4	45	44	Female	53.46.1
Cook Islands vessel 2	124	34	4	3			34	39	Female	53.46.2
Cook Islands vessel 2	125	33	4	3	29	4	62	44	Female	53.46.3
Cook Islands vessel 2	126	26	3	2	19	4	45	46	Male	53.46.5
Cook Islands vessel 2	127	36	4	2	21	3	57	41	Male	53.46.7
Cook Islands vessel 2	128	31	3	0			31	48	Female	53.46.10
Cook Islands vessel 2	129	28	4	2	72	4	100	34	Male	53.212.1
Cook Islands vessel 2	130	41	3	3			41	42	Female	53.212.2
Cook Islands vessel 2	131	28	3	2	13	4	41	41	Female	53.212.5
Cook Islands vessel 2	132	31	3	0			31	38	Female	53.212.6
Cook Islands vessel 2	133	33	3	0			33	37	Male	53.212.7
Cook Islands vessel 2	134	78	4	3			78	48	Male	53.243.1
Cook Islands vessel 2	135	39	4	2	97	4	136	51	Male	53.243.2
Cook Islands vessel 2	136	183	4	3			183	60	Female	53.243.8
Cook Islands vessel 2	137	39	3	2	14	4	53	51	Female	53.243.9
Cook Islands vessel 2	138		5					51	Female	54.6.6
Cook Islands vessel 2	139	57	3	3			57	53	Female	54.21.1
Cook Islands vessel 2	140	50	3	3			50	38	Female	54.21.2
Cook Islands vessel 2	141	30	4	2	7	3	37	41	Male	54.21.4
Cook Islands vessel 2	142	29	4	2	13	4	42	42	Male	54.21.5

Origin	Prep_no	0-TZ	R1	TZR	TZ-E	R2	Total	Length	Sex	oto_id
Cook Islands vessel 2	143	30	4	2	14	4	44	48	Female	54.21.9
Cook Islands vessel 2	144	30	4	2	28	4	58	50	Female	54.32.1
Cook Islands vessel 2	145	33	4	2	32	4	65	48	Male	54.32.2
Cook Islands vessel 2	146	37	4	2	14	3	51	47	Female	54.32.3
Cook Islands vessel 2	147	32	4	2	17	3	49	46	Female	54.32.8
Cook Islands vessel 2	148		5					49	Female	54.32.9
Cook Islands vessel 2	149	25	3	2	9	4	34	43	Male	54.32.10
Cook Islands vessel 2	150	28	3	2	22	4	50	51	Female	54.40.1
Cook Islands vessel 2	151	36	4	3			36	55	Female	54.40.2
Cook Islands vessel 2	152	36	3	0			36	42	Female	54.40.3
Cook Islands vessel 2	153	37	3	2	15	4	52	49	Female	54.40.6
Cook Islands vessel 2	154	37	4	3			37	47	Female	54.40.7
Cook Islands vessel 2	155	31	4	1	15	4	46	48	Female	54.40.8
Cook Islands vessel 2	156	36	4	2	33	4	69	52	Male	54.40.10
Cook Islands vessel 2	157	30	3	1	17	3	47	53	Female	54.149.1
Cook Islands vessel 2	158	27	4	1	73	4	100	50	Male	54.149.2
Cook Islands vessel 2	159	30	3	2	22	4	52	48	Female	54.149.3
Cook Islands vessel 2	160	37	3	3			37	40	Male	54.149.8
Cook Islands vessel 2	161	25	3	2	22	3	47	48	Male	54.149.9
Cook Islands vessel 2	162	24	3	2	33	4	57	48	Male	54.149.10
Cook Islands vessel 2	163	24	4	2	11	3	35	42	Male	54.202.1
Cook Islands vessel 2	164	35	3	3			35	39	Male	54.202.2
Cook Islands vessel 2	165	26	4	2	26	4	52	46	Male	54.202.3
Cook Islands vessel 2	166	35	4	2	110	3	145	51	Female	54.202.4
Cook Islands vessel 2	167	42	3	3			42	48	Female	54.202.5
Cook Islands vessel 2	168	37	3	2	19	4	56	46	Male	54.202.6
Cook Islands vessel 2	169	32	4	0			32	36	Male	54.202.7
Cook Islands vessel 2	170	31	3	0			31	35	Male	54.202.8
Cook Islands vessel 2	171	35	3	2	34	4	69	46	Male	54.202.9
Cook Islands vessel 2	172	23	3	0			23	48	Male	54.202.10
Cook Islands vessel 2	173	30	3	2	75		105	53	Male	54.212.1
Cook Islands vessel 2	174	27	3	2	53	4	80	47	Female	54.212.2
Cook Islands vessel 2	175	34	3	2	77	4	111	48	Female	54.212.3
Cook Islands vessel 2	176	28	3	0			28	47	Female	54.212.4
Cook Islands vessel 2	177	46	4	3			46	49	Male	54.212.5
Cook Islands vessel 2	178	33	4	2	37	4	70	50	Male	54.212.6
Cook Islands vessel 2	179	33	3	0			33	44	Female	54.212.7
Cook Islands vessel 2	180	24	3	1	36	3	60	48	Female	54.212.8
Cook Islands vessel 2	181	35	3	0			35	45	Female	54.212.9

Origin	Prep_no	0-TZ	R1	TZR	TZ-E	R2	Total	Length	Sex	oto_id
Cook Islands vessel 2	182	31	3	0			31	41	Male	55.37.1
Cook Islands vessel 2	183	29	3	2	8	4	37	42	Male	55.37.2
Cook Islands vessel 2	184	39	4	2	5	3	44	41	Female	55.37.4
Cook Islands vessel 2	185	27	4	0			27	41	Male	55.37.5
Cook Islands vessel 2	186	31	3	2	16	4	47	50	Female	55.37.6
Cook Islands vessel 2	187	63	4	3			63	43	Male	55.37.7
Cook Islands vessel 2	188	34	4	3			34	43	Female	55.37.8
Cook Islands vessel 2	189	41	4	3			41	45	Male	55.108.1
Cook Islands vessel 2	190	38	4	3			38	41	Male	55.108.3
Cook Islands vessel 2	191	40	3	1	17	3	57	52	Female	55.108.4
Cook Islands vessel 2	192	38	4	2	38	4	76	50	Female	55.108.5
Cook Islands vessel 2	193	29	3	2	22	4	51	52	Female	55.108.6
Cook Islands vessel 2	194	30	3	2	21	4	51	48	Female	55.108.10
Cook Islands vessel 2	195	36	4	2	16	4	52	47	Male	55.141.1
Cook Islands vessel 2	196	57	4	3			57	43	Female	55.141.2
Cook Islands vessel 2	197	31	3	2	9	3	40	47	Female	55.141.4
Cook Islands vessel 2	198	29	4	2	23	4	52	42	Male	55.141.5
Cook Islands vessel 2	199	30	4	2	16	4	46	49	Female	55.141.8
Cook Islands vessel 2	200	28	3	0			28	46	Male	55.141.9
Cook Islands vessel 2	201	34	3	1	29	3	63	52	Female	55.324.6
Cook Islands vessel 2	202	34	4	3			34	44	Female	55.324.7
Cook Islands vessel 2	203	35	3	2	84	4	119	50	Male	55.324.8
Cook Islands vessel 2	204	37	4	3			37	44	Male	55.324.10
Cook Islands vessel 2	205	32	3	3	35	4	67	48	Male	57.161.2
Cook Islands vessel 2	206	26	4	0			26	46	Male	57.161.4
Cook Islands vessel 2	207	30	3	0			30	42	Male	57.161.5
Cook Islands vessel 2	208	35	3	0			35	43	Male	57.161.8
Cook Islands vessel 2	209	27	4	2	9	3	36	40	Male	57.161.10
Cook Islands vessel 2	210	31	3	1	26	4	57	48	Female	59.144.2
Cook Islands vessel 2	211	35	3	0			35	41	Male	59.144.4
Cook Islands vessel 2	212	34	3	0			34	46	Female	59.144.5
Cook Islands vessel 2	213	28	3	2	29	4	57	44	Male	59.144.6
Cook Islands vessel 2	214	31	4	3			31	44	Female	59.144.7
Cook Islands vessel 2	215	27	4	2	22	4	49	55	Female	59.144.8
Cook Islands vessel 2	216	32	3	2	13	3	45	48	Female	59.144.9
Cook Islands vessel 2	217	28	3	2	14	4	42	45	Male	59.144.10
Cook Islands vessel 2	218	35	3	0			35	40	Female	59.153.1
Cook Islands vessel 2	219	33	4	0			33	44	Female	59.153.2
Cook Islands vessel 2	220	33	3	2	19	4	52	46	Female	59.153.3

Origin	Prep_no	0-TZ	R1	TZR	TZ-E	R2	Total	Length	Sex	oto_id
Cook Islands vessel 2	221	31	3	0			31	40	Female	59.153.4
Cook Islands vessel 2	222	30	3	2	24	4	54	47	Female	59.153.5
Cook Islands vessel 2	223	29	3	2	17	4	46	43	Female	59.153.6
Cook Islands vessel 2	224	31	3	0			31	42	Female	59.153.7
Cook Islands vessel 2	225	42	4	3			42	53	Female	59.153.8
Cook Islands vessel 2	226	30	3	0			30	46	Female	59.153.9
Cook Islands vessel 2	227	25	3	0			25	35	Female	59.153.10
Cook Islands vessel 2	228	34	4	2	22	4	56	46	Male	57.161.9
Cook Islands vessel 2	229	34	4	2	38	4	72	50	Male	64.13.1
Cook Islands vessel 2	230	31	3	2	35	4	66	48	Male	64.13.2
Cook Islands vessel 2	231	41	3	3			41	43	Female	64.13.3
Cook Islands vessel 2	232	70	3	3			70	51	Female	64.13.4
Cook Islands vessel 2	233	32	3	1	8	4	40	47	Female	64.13.5
Cook Islands vessel 2	234	19	4	0			19	39	Male	64.13.6
Cook Islands vessel 2	235	33	3	2	32	3	65	48	Female	64.13.7
Cook Islands vessel 2	236	26	3	0			26	39	Female	64.13.8
Cook Islands vessel 2	237	33	3	2	59	4	92	50	Female	64.13.9
Cook Islands vessel 2	238	28	3	1	45	4	73	50	Female	64.13.10
Cook Islands vessel 2	239	53	4	3			53	46	Male	64.88.1
Cook Islands vessel 2	240	23	3	2	65	4	88	47	Male	64.88.2
Cook Islands vessel 2	241	28	3	2	74	4	102	48	Male	64.88.3
Cook Islands vessel 2	242	59	4	3			59	47	Male	64.88.4
Cook Islands vessel 2	243	54	4	3			54	47	Male	64.88.5
Cook Islands vessel 2	244	42	3	3			42	41	Male	64.88.6
Cook Islands vessel 2	245	32	3	2	46	3	78	48	Male	64.88.7
Cook Islands vessel 2	246	47	4	3			47	44	Male	64.88.8
Cook Islands vessel 2	247	37	3	3			37	42	Male	64.88.9
Cook Islands vessel 2	248	30	3	0			30	41	Male	64.88.10
Cook Islands vessel 2	249	26	3	2	19	4	45	50	Female	64.133.1
Cook Islands vessel 2	250	24	3	2	22	4	46	46	Female	64.133.2
Cook Islands vessel 2	251	28	2	0			28	39	Female	64.133.3
Cook Islands vessel 2	252	28	3	1	16	3	44	49	Female	64.133.4
Cook Islands vessel 2	253	32	4	0			32	41	Female	64.133.5
Cook Islands vessel 2	254	26	3	1	38	4	64	45	Male	64.133.6
Cook Islands vessel 2	255	45	4	3			45	43	Female	64.133.7
Cook Islands vessel 2	256	29	3	2	53	3	82	46	Male	64.133.8
Cook Islands vessel 2	257	37	4	2	34	4	71	43	Male	64.133.9
Cook Islands vessel 2	258	33	4	3			33	50	Male	64.133.10
Cook Islands vessel 2	259	35	3	1	80	4	115	45	Male	64.135.1

Origin	Prep_no	0-TZ	R1	TZR	TZ-E	R2	Total	Length	Sex	oto_id
Cook Islands vessel 2	260	30	4	2	37	4	67	45	Male	64.135.2
Cook Islands vessel 2	261	29	3	2	53	4	82	43	Male	64.135.3
Cook Islands vessel 2	262	33	3	0			33	37	Male	64.135.4
Cook Islands vessel 2	263	30	4	2	28	4	58	40	Male	64.135.5
Cook Islands vessel 2	264	36	4	2	26	4	62	47	Male	64.135.6
Cook Islands vessel 2	265	68	3	3			68	47	Male	64.135.7
Cook Islands vessel 2	266	39	4	3			39	43	Male	64.135.9
Cook Islands vessel 2	267	29	4	3			29	43	Male	64.135.10
Cook Islands vessel 2	268	33	4	3			33	40	Male	64.139.1
Cook Islands vessel 2	269	27	3	0			27	30	Female	73.42.4
Cook Islands vessel 2	270	22	4	0			22	34	Female	73.42.9
Cook Islands vessel 2	271	25	4	0			25	31	Female	73.42.21
Cook Islands vessel 2	272	31	3	0			31	37	Male	73.42.38
Cook Islands vessel 2	273	25	4	0			25	33	Female	73.42.47
Cook Islands vessel 2	274	26	3	0			26	33	Female	73.42.70
Cook Islands vessel 2	275	28	3	0			28	34	Female	73.42.86
Cook Islands vessel 2	276	30	3	2	8		38	39	Male	73.55.27
Cook Islands vessel 2	277	39	4	3			39	35	Female	73.55.44
Cook Islands vessel 2	278	27	3	2	18	3	45	46	Male	71.243.1
Cook Islands vessel 2	279	20	4	0			20	35	Female	71.243.2
Cook Islands vessel 2	280	57	4	3			57	53	Female	71.243.4
Cook Islands vessel 2	281	28	3	2	46	4	74	53	Female	71.243.5
Cook Islands vessel 2	282	29	4	3			29	41	Male	71.243.6
Cook Islands vessel 2	283	38	4	3			38	41	Male	71.243.7
Cook Islands vessel 2	284	31	4	3			31	43	Female	71.243.8
Cook Islands vessel 2	285	38	4	3			38	44	Male	71.243.9