



BRANCH: FISHERIES MANAGEMENT
SCIENTIFIC WORKING GROUP – SMALL PELAGICS

RESULTS OF THE 2018 PELAGIC BIOMASS SURVEY

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(with acknowledgements to all other survey participants)

The 35th consecutive annual November hydro-acoustic pelagic biomass survey was conducted on board FRS *Africana* over a 42-day period, with the first leg from the 18th October to the 5th November (Hondekliip Bay to Cape Agulhas) and the second leg from the 9th November to 1st December.

The survey departed only two days after the requested departure date, following a lengthy period of mechanical repair to the propulsion system. A week of sea trials, including acoustic noise trials and the calibration of the 38, 120 and 200 kHz transducers was completed immediately prior to departing on the survey. Despite the extensive repair schedule and the sea trials, 2 days of survey time was still lost during the first leg and an extended changeover in Cape Town was required to deal with mechanical issues. During the second leg the trawl winch started leaking hydraulic fluid again but the crew managed to deal with this problem and it didn't interfere with trawling operations.

Additionally, at least 2 days were lost due to bad weather during the first leg of the survey, with the ship having to heave to off Hermanus and Quoin Point as there was no place to shelter. The effective survey time was therefore only 40 days and the survey was extended to Port St Johns, as good progress was made during the second leg.

The continental shelf between Hondekliip Bay on the West Coast and Port St Johns on the East Coast was surveyed (Figure 1). A total of 76 transects were sampled, 571 acoustic intervals logged and 117 target identification hauls conducted, compared with 60 transects and 115 trawls in 2017. Environmental, plankton and ichthyoplankton (CUFES and CalVET) sampling was conducted along predetermined transects – CUFES was run continuously, whereas 10 nm CalVET, Bongo and CTD stations were occupied along 21 transects (4 each in strata C, E and F and 3 in stratum A, B and D).

Echo-sounder system

The acoustic system used on board FRS *Africana* comprised 4 Simrad EK60 GPTs operating at 18, 38, 120 and 200 kHz. Calibration of the acoustic system (38, 120 and 200 kHz) was conducted in Table Bay during the sea trials, a week before the survey started. Results from the Lobe calibration software were downloaded to the GPT after careful post processing prior to departure. An additional small linear correction factor

of 1.06 was applied to the survey data during post processing to account for the S_A correction factor bias typically inherent in the Lobe calibration software.

During the survey acoustic signals were logged to a depth of 250 m except off the shelf where the maximum depth was increased to 500m and processed using version 8.0.86 of Myriax Echoview® echo-integration software. All raw data were stored and backed up onto removable USB drives.

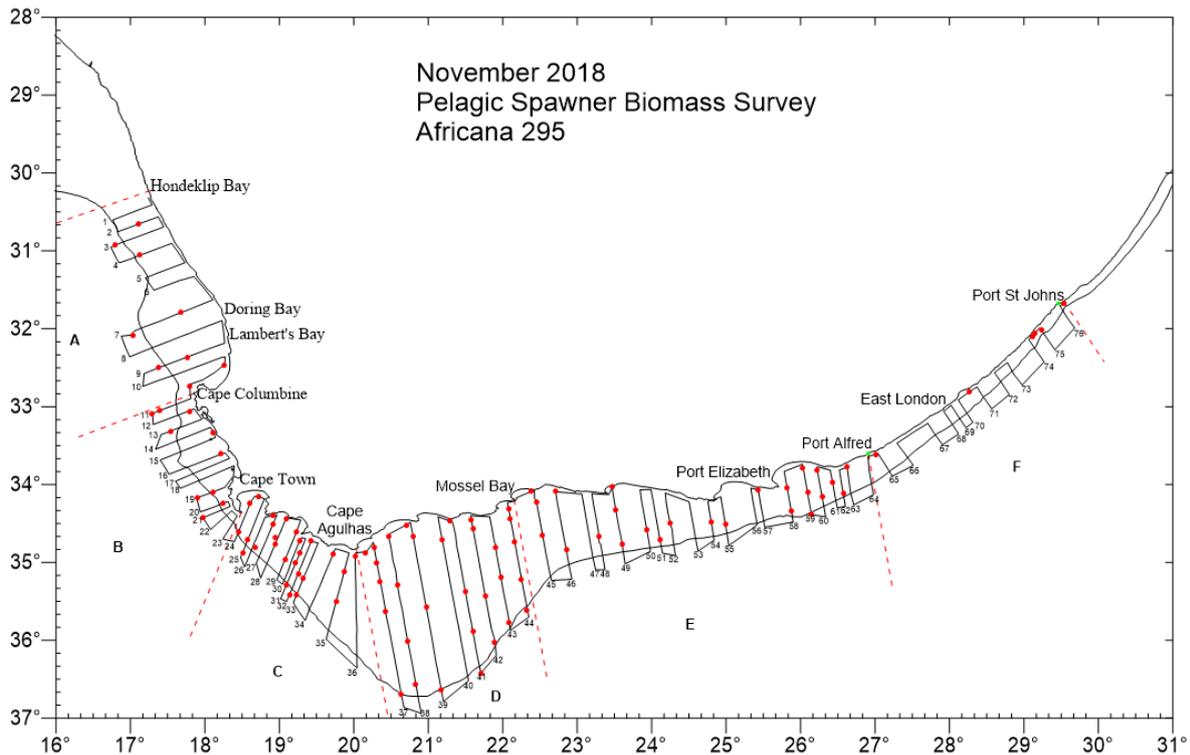


Figure 1. Cruise track and positions of the mid-water trawls.

Fish distribution patterns and length frequencies

Distribution maps and weighted length frequencies of anchovy, sardine, redeye and horse mackerel are presented below. The main patterns are as follows:

(i) Anchovy

Recruit anchovy were found in very low densities in St Helena Bay but the contribution to the distribution map was minimal (Figure 2). Anchovy increased in densities between Cape Point and Cape Agulhas where they occupied most of the shelf area, and had a model length of 9 cm. Anchovy increased in density and size further eastwards, towards Mossel Bay and between Port Elizabeth and Port Alfred. A few anchovy were also found north of Port Alfred. What was noticeable was the lack of anchovy offshore on the central Agulhas Bank, with most of the anchovy found inshore, 20 to 30 nm from the coast.

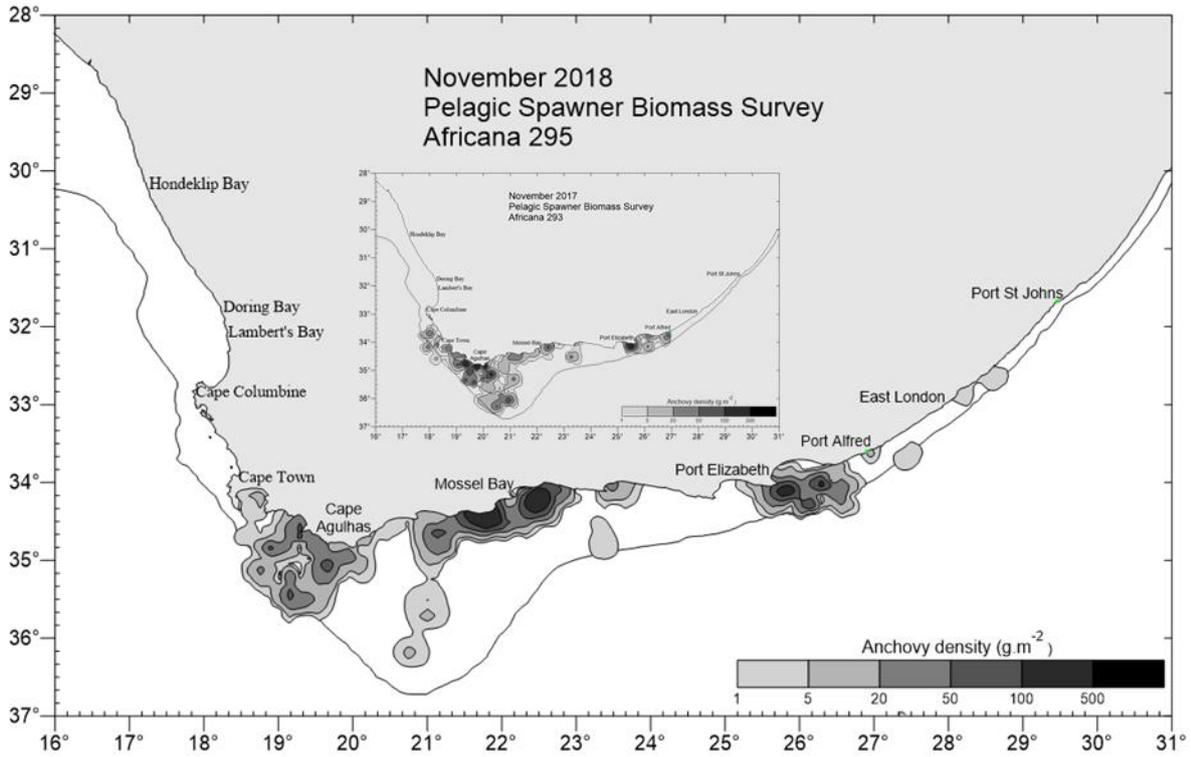


Figure 2. Distribution and relative density of anchovy as observed during the 2018 pelagic biomass survey. Inset for 2017.

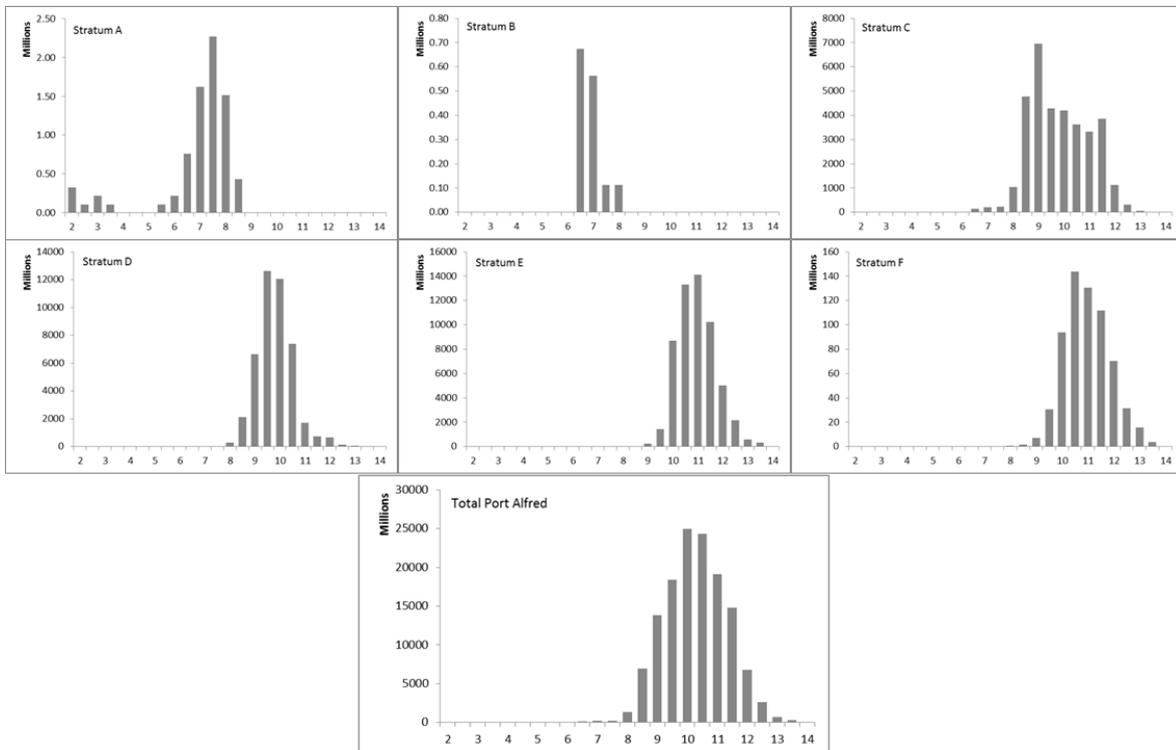


Figure 3. Acoustically weighted length frequency distributions for anchovy per stratum and for the survey up to Port Alfred, caudal length (cm). Stratum F didn't add more to the Port Alfred graph

The anchovy found in St Helena Bay had a bi-modal length distribution with a few fish at 3cm caudal length and a dominant mode at 7.5 cm caudal length. Between Cape Point and Cape Agulhas, the modal length of anchovy was around 9 cm. Surveying eastwards the size of anchovy increased, Cape Agulhas to Mossel Bay having a peak at 9.5 cm caudal length and Mossel Bay to Port Alfred had slightly larger fish with the modal peak at 11 cm. North of Port Alfred the numbers of anchovy decreased but the size of fish remained more or less the same at 11 cm caudal length. The combined acoustically weighted length frequency had a unimodal distribution with a peak at 10 cm, which was the same as last year. (Figure 3).

(ii) Sardine

Only 1500 t of sardine was found in a low density patch off Saldanha (Figure 4). A higher density concentration of sardine was detected in False Bay, which didn't extend out of the Bay. A smaller patch of sardine, though small in average size (12 cm caudal length) was found off Quoin Point. A further high density patch of sardine was found inshore off Cape Agulhas. Very few sardines were detected offshore except off Port Elizabeth and the relatively high densities of sardine found in Algoa Bay during the 2017 biomass survey were absent in that area during 2018. A small patch of sardine was found off Port St Johns but this only amounted to some 12 000 tonnes.

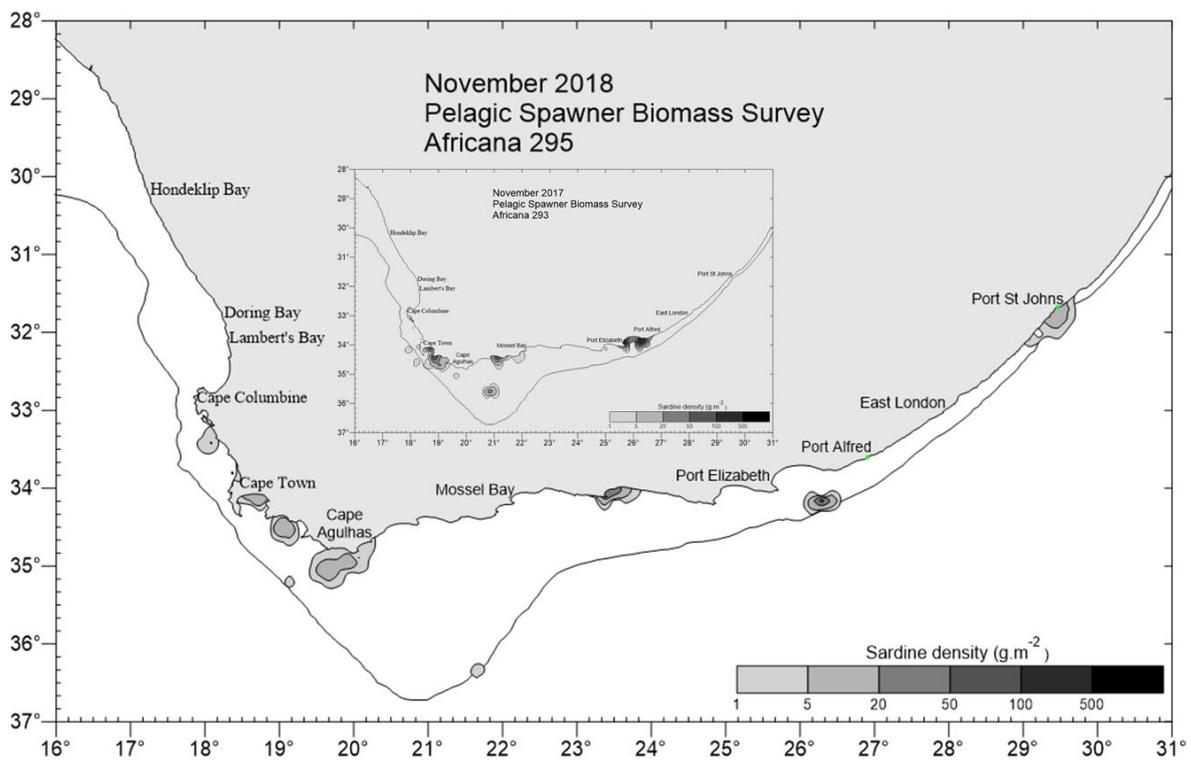


Figure 4. Distribution and relative density of sardine as observed during the 2018 pelagic biomass survey. Inset for 2017.

The length distribution of sardine on the west coast was dominated by recruits with a combined modal peak at 4 to 5 cm caudal length (Figure 5). Between Cape Point and Cape Agulhas 3 modal peaks were observed, one at 7cm then 10 cm and finally at 12 cm caudal

length. Even further east the sardine remained fairly small in size. The only large sardine observed was off Port St Johns with a mean length of 16 cm caudal length.

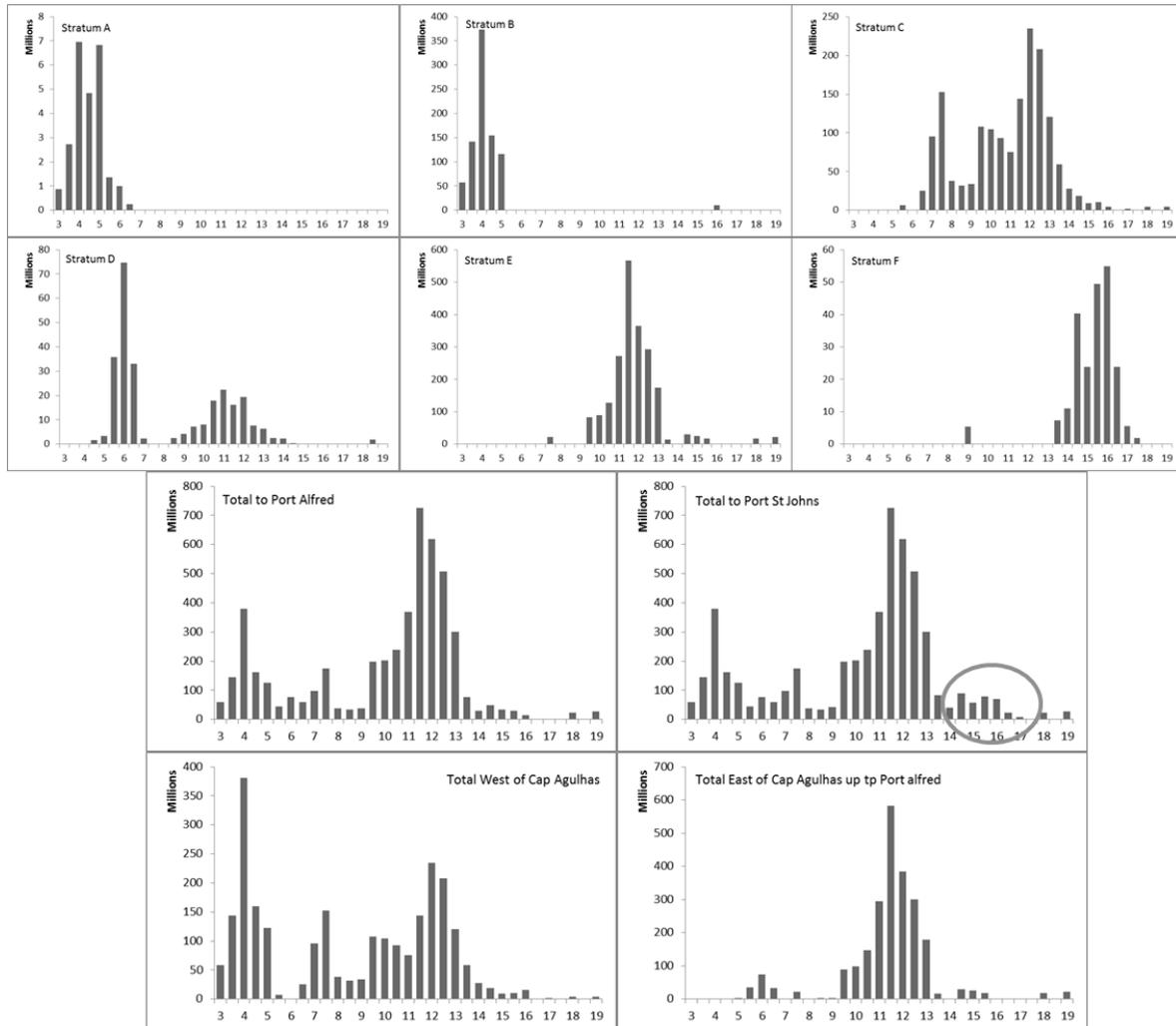


Figure 5. Acoustically weighted length frequency distributions for sardine per stratum and for the whole survey, caudal length (cm). Stratum F only contributed a small portion to the east of Cape Agulhas portion.

(iii) Redeye

The distribution of redeye round herring was widespread over most parts of the survey area (Figure 6). Round herring were found both on the West Coast, with highest densities off Cape Columbine, and in low to moderate densities over the entire Agulhas Bank from close inshore to the shelf edge.

Round herring found on the west coast were small, 4.5 to 5 cm with the redeye found offshore off Cape Columbine much larger at 17 cm. Between Cape Point and Cape Agulhas there were two distinct cohorts of 7 cm and 15 cm. The bulk of the redeye were encountered in stratum D, between Cape Agulhas and Mossel Bay. Though there were still two cohorts present, the area was dominated by 15 to 16 cm fish. These larger fish also dominated the length frequency in the area east of Mossel Bay. The length frequency distribution for the entire area is dominated by a strong cohort with a mode at 15.5 cm

with secondary modes at 7.5 and 11.5 cm (Figure 7) which is slightly smaller than last year.

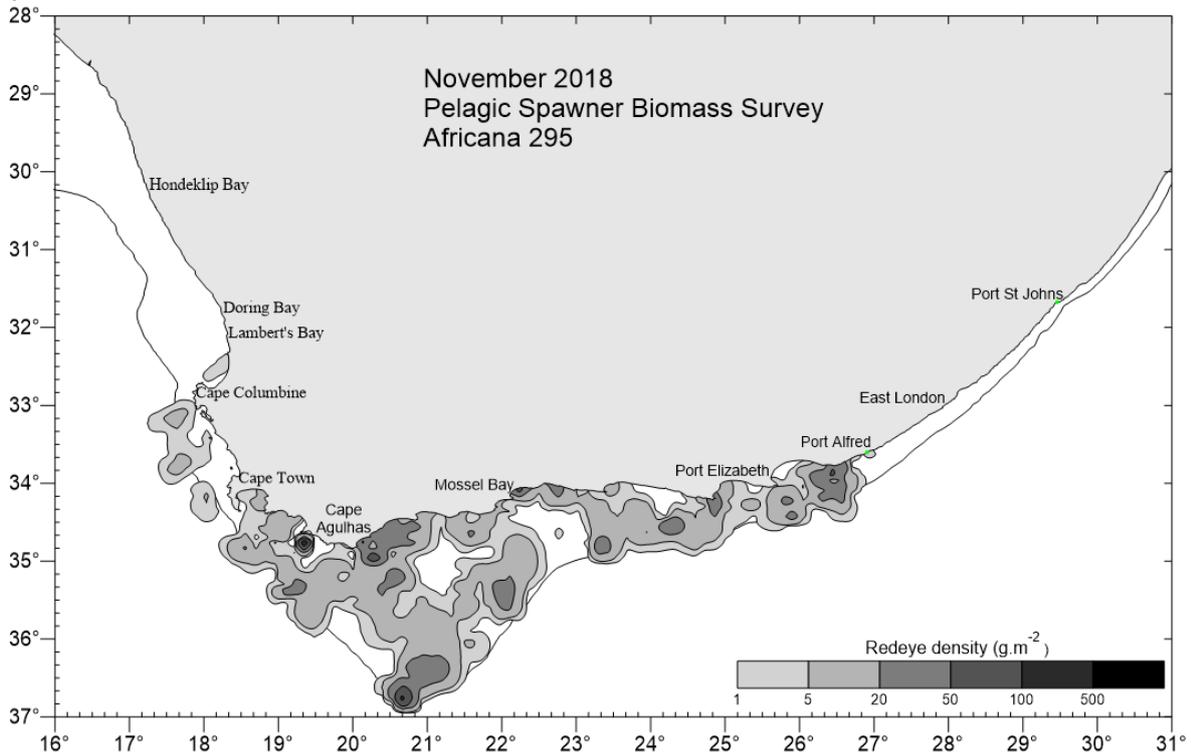


Figure 6. Distribution and relative density of redeye round herring observed during the 2018 pelagic biomass survey.

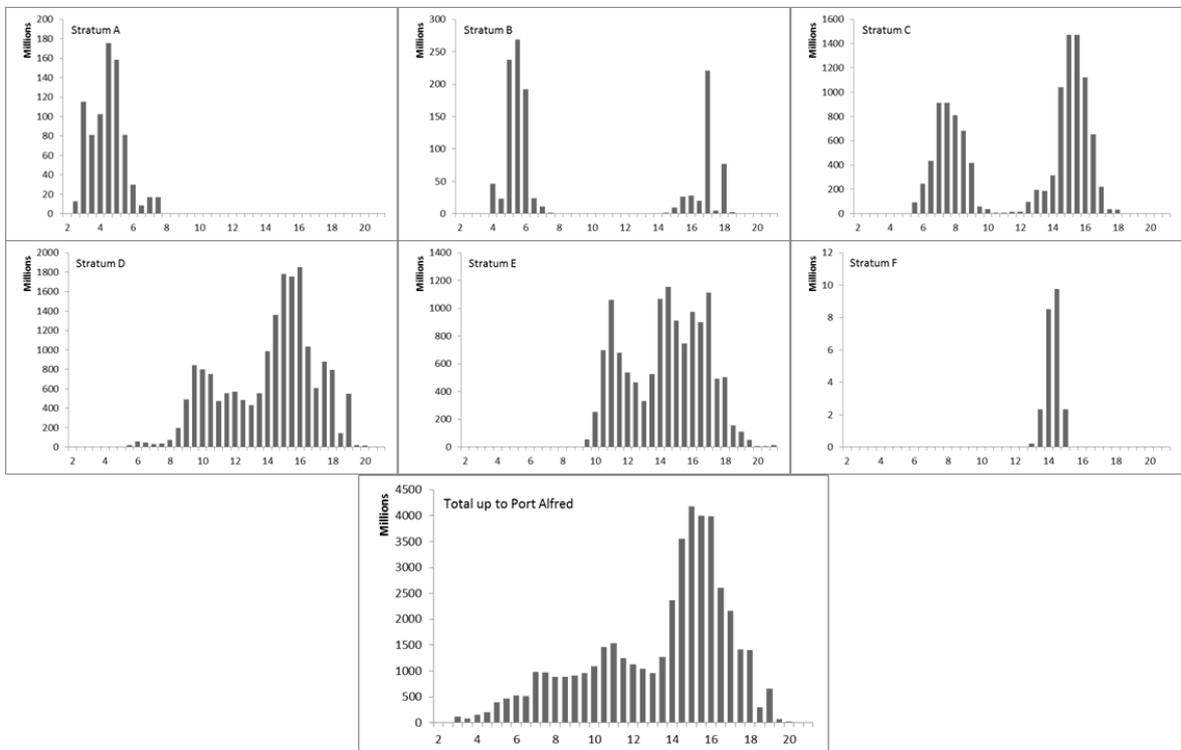


Figure 7. Acoustically weighted length frequency distributions for redeye per stratum and for the survey up to Port Alfred, caudal length (cm).

(iv) Horse mackerel

Only low densities of horse mackerel ($<0.1 \text{ g.m}^{-2}$, not shown in Figure 8) were found on the west coast, these being dominated by fish less than 4 cm. A few low density patches of recruit horse mackerel were detected towards the shelf edge, between Cape Point and Cape Agulhas but the bulk of the horse mackerel was found on the shelf edge between Cape Agulhas and Mossel Bay (Figure 8). Overall, as is expected, the horse mackerel caught incidentally with pelagic fish over the entire survey area were small with only a few larger fish found (Figure 9) over the shelf edge south of Mossel Bay.

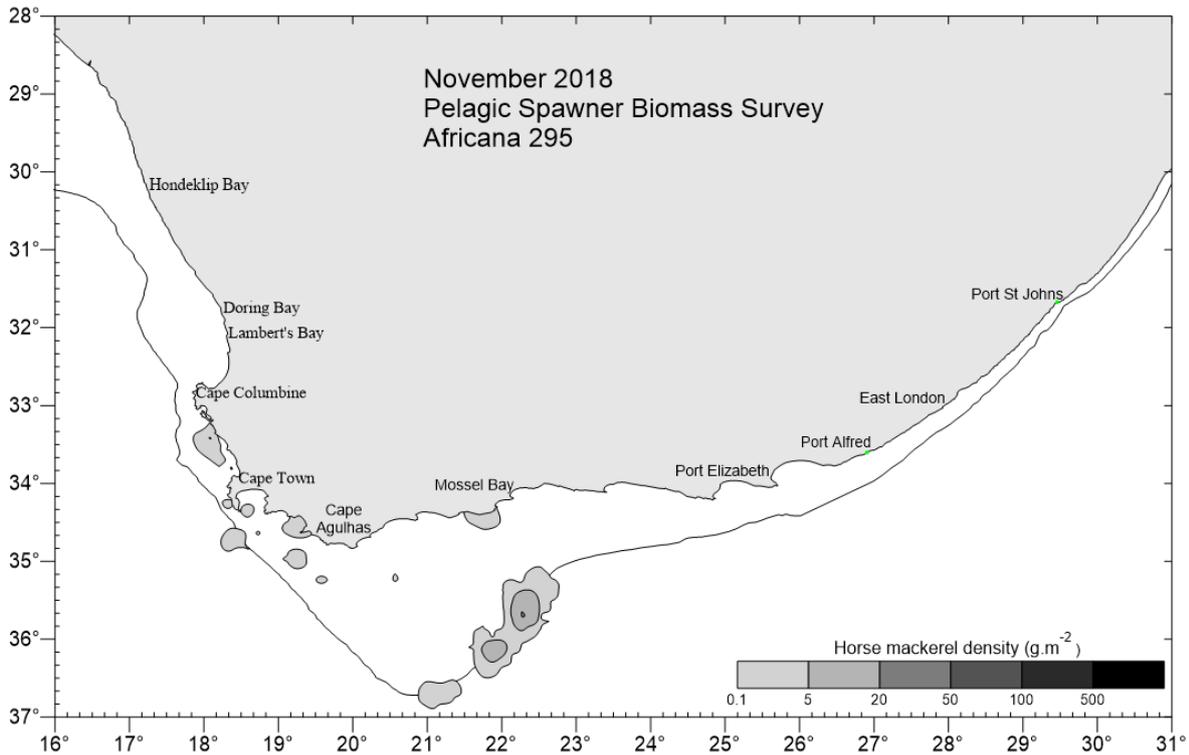


Figure 8. Distribution and relative density of horse mackerel, note the minimum density is 0.1 g.m^{-2} .

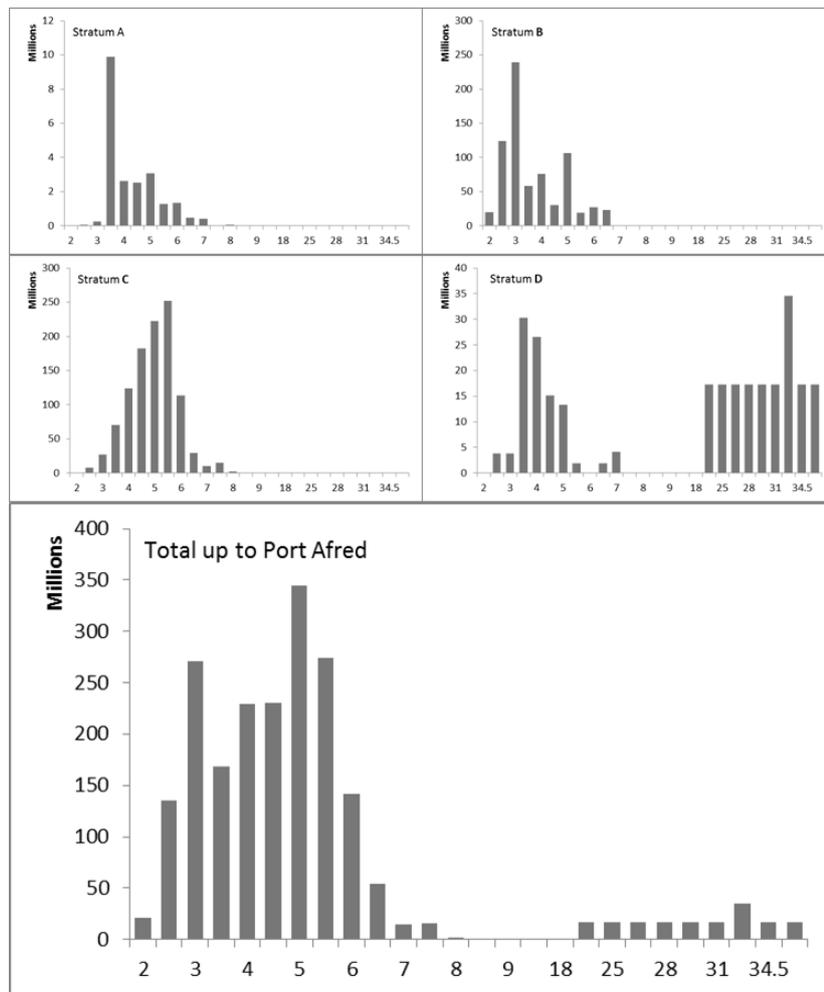


Figure 9. Acoustically weighted length frequency distributions for horse mackerel per stratum and for the entire survey, total length (cm).

Stock size

Biomass estimates for the November 2018 pelagic biomass survey are presented in Table 1 and the time-series of acoustic estimates since 1984 are given in Table 2.

Anchovy biomass was estimated at around 1.56 million tonnes (Table 1), virtually the same as that estimated in 2017 and below the long term (1984-2017) average of 2.24 million tonnes. The sardine biomass of just over 90 000 tonnes is less than a third of the 335 thousand tonnes estimated in 2017 and also well below the long-term (1984-2017) average of 912 thousand tonnes for this species. The redeye round herring biomass estimate of 1.41 million tonnes is slightly higher than that measured in 2017 and almost identical to that estimated in 2016 and remains higher than the long-term (1984-2017) average of 995 thousand tonnes. The estimated CVs, which reflect sampling variance only, of all three species' biomass estimates are within the previously observed range. The biomass estimates reported for horse mackerel reflects only that portion of the biomass that was effectively sampled during pelagic trawling operations.

Table 1. Pelagic fish biomass (tonnes) and associated CVs per stratum. Also given is the total biomass (t) for each species and the biomass located to the west and east of Cape Agulhas.

Stratum	Area	Anchovy	CV	Sardine	CV	Redeye	CV	Horse Mackerel	CV
A	HKB-CC	16	0.776	37	0.776	641	0.776	19	0.523
B	CC-CP	4	0.748	1 579	0.752	22 747	0.323	467	0.399
C	CP-CA	356 093	0.205	33 229	0.375	285 120	0.323	1 813	0.522
D	CA-MB	461 588	0.370	3 118	0.637	630 760	0.246	41 823	0.751
E	MB-PA	741 846	0.426	52 805	0.828	467 620	0.218	-	-
F	PA-PSJ	8 906	0.489	11 581	0.786	789	0.792	-	-
Total to Port Alfred		1 559 546	0.235	90 768	0.502	1 406 888	0.147	44 122	0.712
Total to Port St Johns		1 568 452	0.234	102 348	0.454	1 407 677	0.147	44 122	0.712
Biomass West of CA		356 113	0.205	34 845	0.359	308 509	0.300	2 299	0.419
Biomass East of CA		1 203 433	0.298	55 922	0.783	1 098 380	0.169	41 823	0.751
Proportion west		0.228		0.384		0.219		0.052	

Overall the total estimate of anchovy, sardine and round herring combined, has remained virtually unchanged since 2017 at just over 3 million tonnes with the decrease in sardine biomass being offset by the increase in round herring biomass (Figure 13).

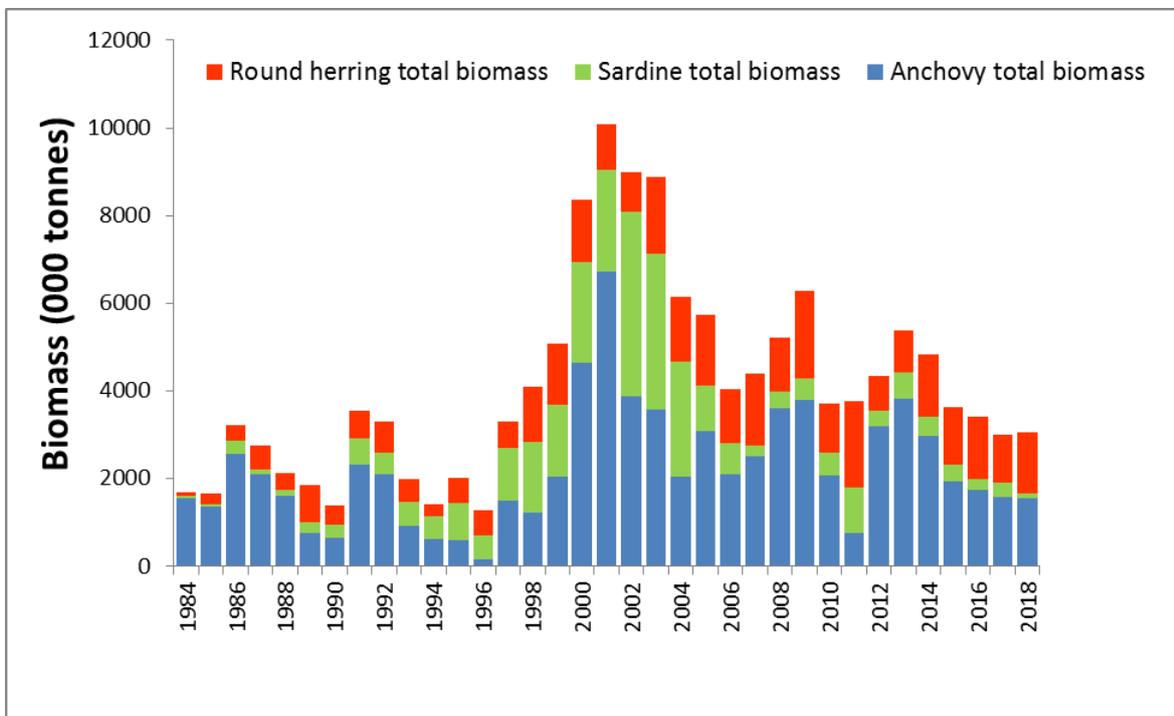


Figure 13. Combined anchovy, sardine and redeye round herring biomass up to Port Alfred.

The biomass of sardine in the area to the west of Cape Agulhas was only 35 thousand tons, representing 38% of the biomass (Table 1, Figure 14). This has decreased sharply from over 100 thousand tonnes in 2017 and is the lowest biomass observed west of Cape Agulhas since 1985. The biomass located to the east of Cape Agulhas has also decreased sharply and is the lowest measured here since 1990. For anchovy the proportion of the biomass found in the area to the west of Cape Agulhas has halved since 2017 from just over 50 % to just under 25% (Figure 14). The combined biomass of anchovy and sardine in the area to the west of Cape Agulhas is less than 400 000 tonnes, representing a decrease of 60% since 2017 and does not bode well for dependent predators in that area. The current low biomass of sardine, in total but also that which is located to the west of Cape Agulhas is cause for concern, especially if future recruitment of sardine is predominantly dependent on successful west coast spawning.

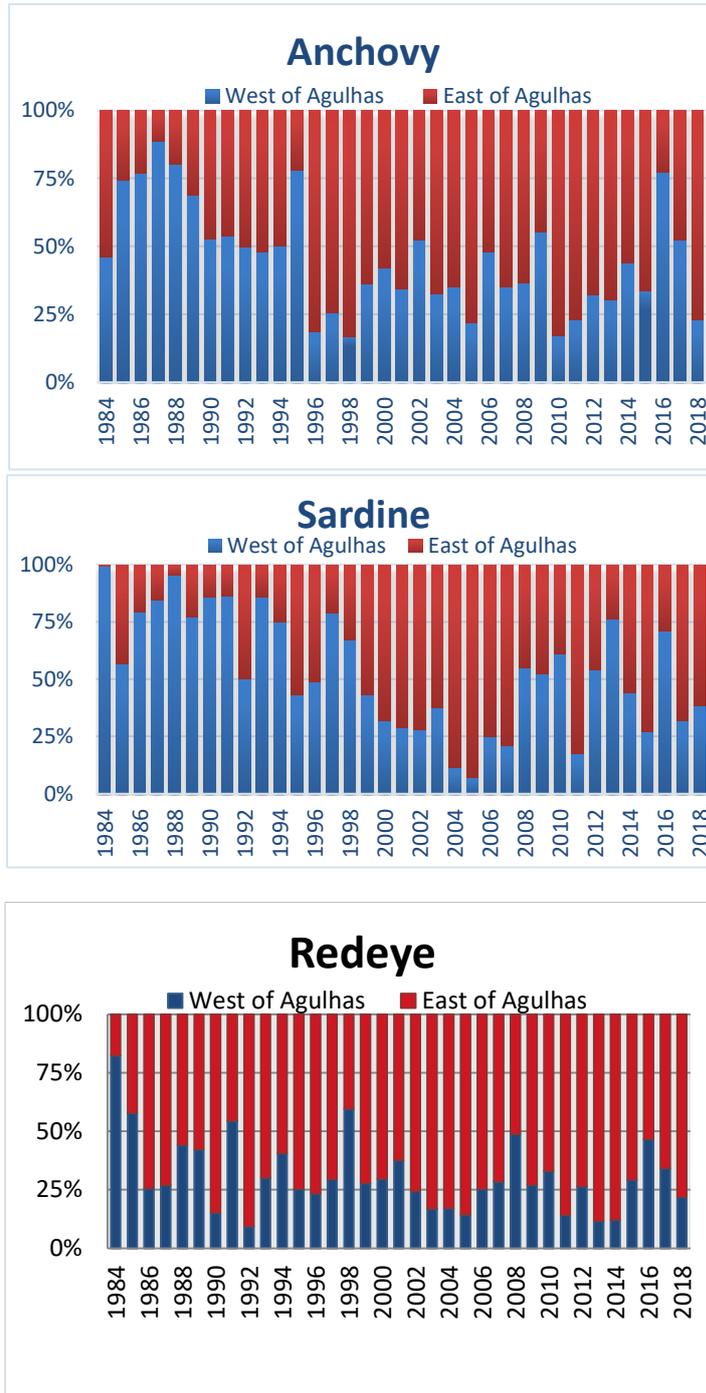


Figure 14. Relative percentage of the biomass found to the west and east of Cape Agulhas. Anchovy (top), sardine(middle) and redeye (bottom).

Table 2. November acoustic estimates of biomass (000 tonnes) and associated CV measured since 1984 up to Port Alfred.

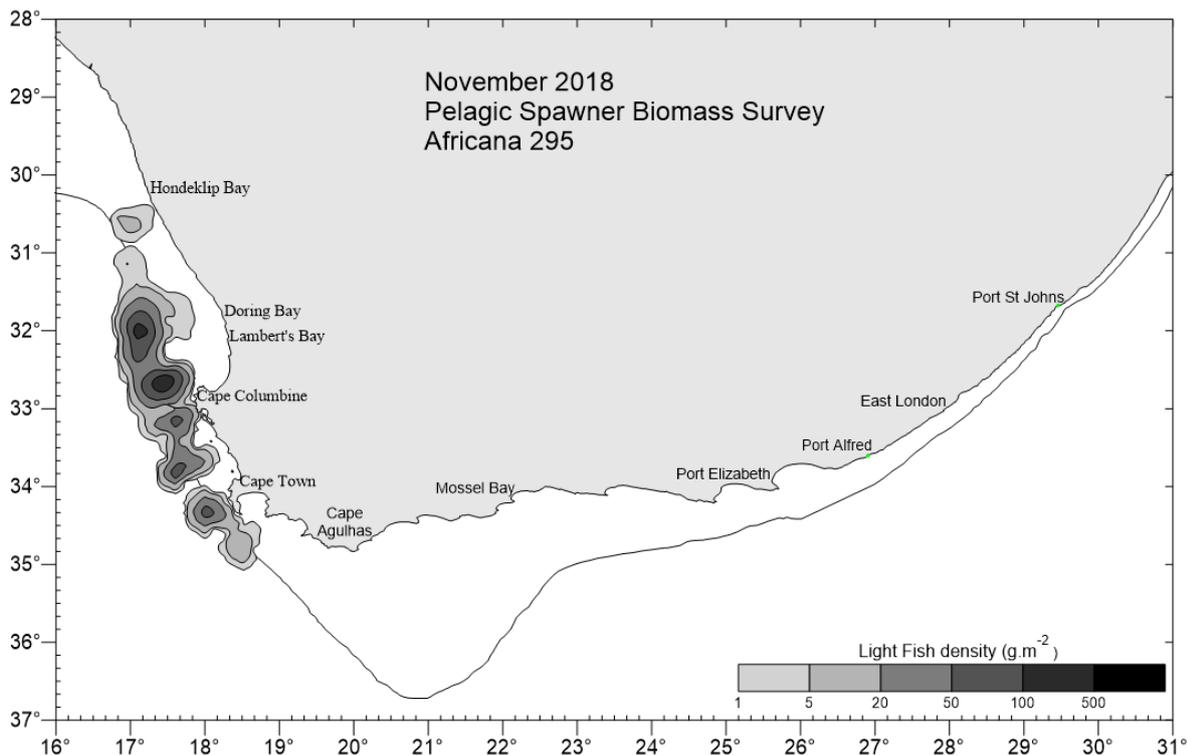
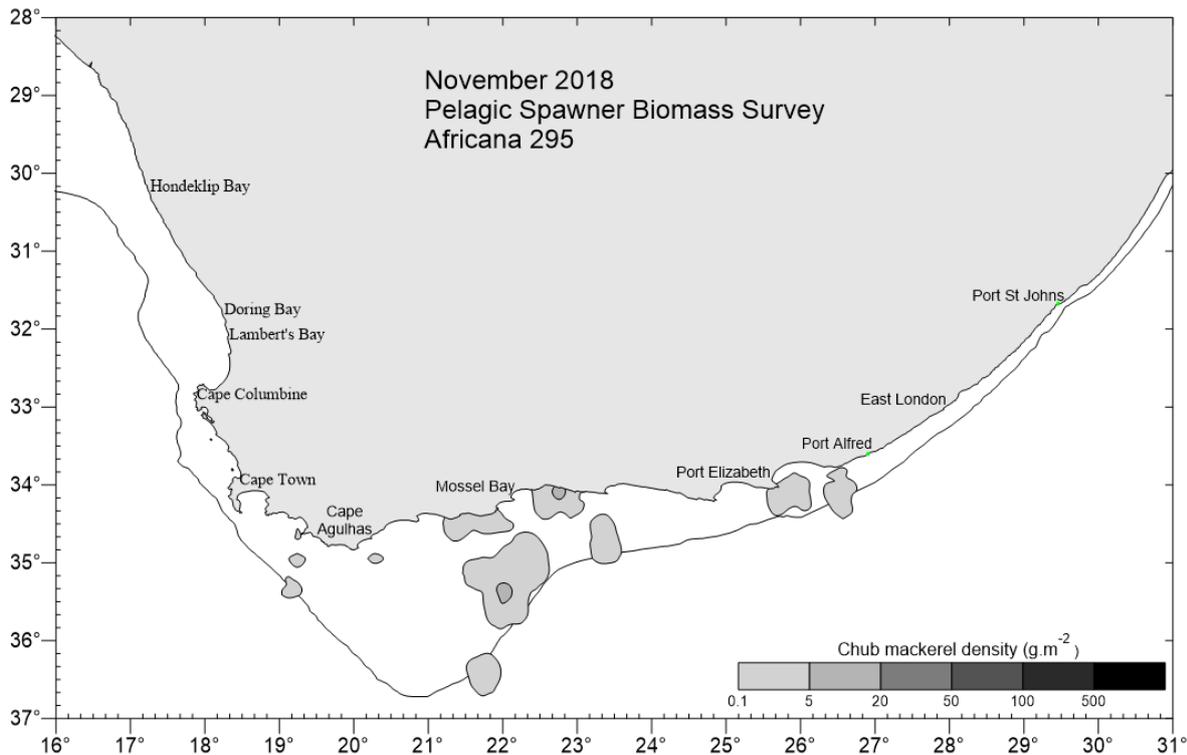
Year	Anchovy	CV	Sardine	CV	Redeye	CV
1984	1 554	0.254	48	0.972	82	0.336
1985	1 366	0.183	45	0.449	257	0.224
1986	2 569	0.148	300	0.696	344	0.297
1987	2 109	0.132	111	0.402	545	0.197
1988	1 607	0.204	134	0.715	377	0.318
1989	752	0.143	257	0.225	836	0.254
1990	652	0.167	290	0.276	441	0.171
1991	2 328	0.140	598	0.308	625	0.242
1992	2 088	0.140	494	0.488	715	0.160
1993	916	0.190	560	0.316	521	0.216
1994	617	0.136	518	0.280	283	0.208
1995	601	0.192	844	0.515	571	0.132
1996	162	0.391	529	0.359	576	0.145
1997	1 483	0.267	1 225	0.244	591	0.280
1998	1 229	0.217	1 607	0.251	1 248	0.149
1999	2 052	0.156	1 635	0.212	1 398	0.171
2000	4 654	0.125	2 292	0.500	1 420	0.169
2001	6 720	0.107	2 310	0.142	1 046	0.131
2002	3 868	0.154	4 206	0.227	918	0.189
2003	3 563	0.236	3 564	0.197	1 762	0.108
2004	2 045	0.131	2 616	0.334	1 475	0.100
2005	3 077	0.144	1 049	0.300	1 616	0.130
2006	2 106	0.136	713	0.346	1 228	0.106
2007	2 508	0.157	257	0.345	1 721	0.153
2008	3 706	0.120	384	0.422	1 260	0.118
2009	3 793	0.136	502	0.271	1 991	0.108
2010	2 077	0.144	508	0.235	1 115	0.134
2011	754	0.204	1 037	0.235	1 961	0.101
2012	3 187	0.116	345	0.344	795	0.145
2013	3 820	0.102	612	0.346	959	0.129
2014	2 971	0.137	445	0.291	1 429	0.178
2015	1 944	0.157	363	0.297	1 315	0.136
2016	1 733	0.227	259	0.352	1 419	0.191
2017	1 568	0.196	334	0.449	1 101	0.169
2018	1 560	0.235	91	0.502	1 407	0.147

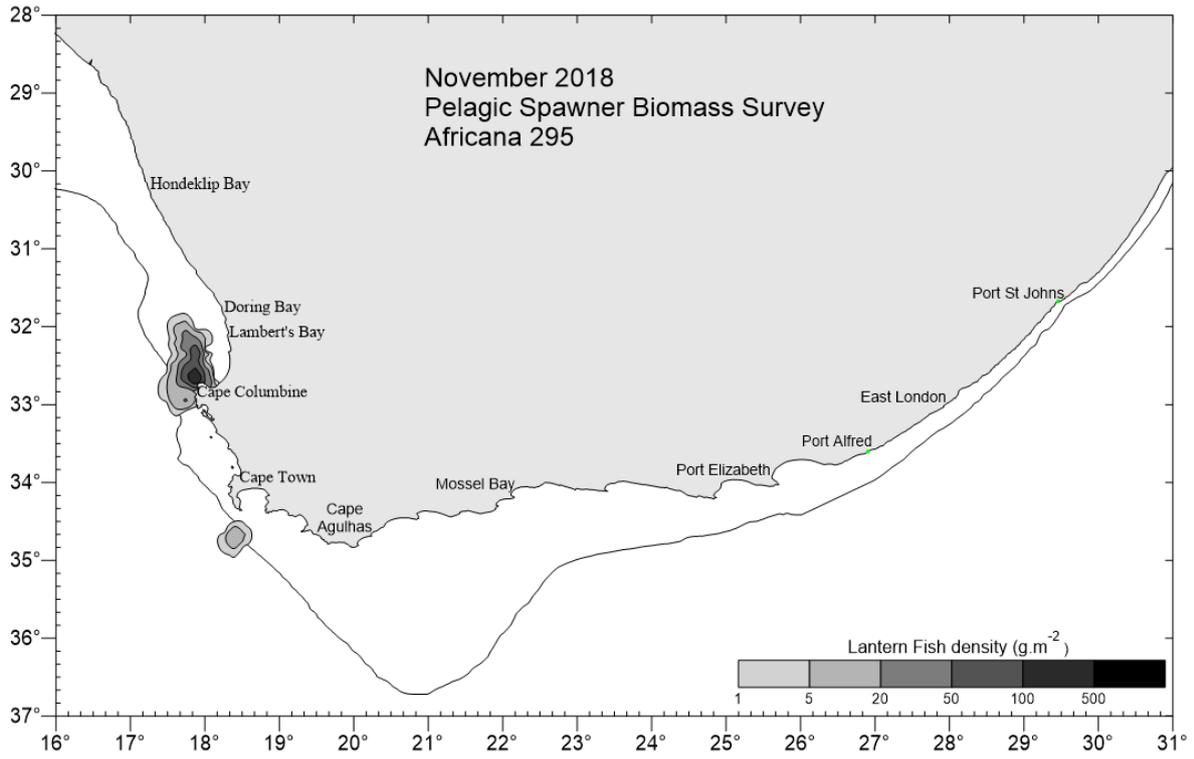
Conclusions

This was the 35th consecutive year that the biomass of anchovy and sardine was measured acoustically in November, and the survey was very successful in terms of coverage of the known distribution of these species. Only a small biomass of sardine and anchovy was located north east of the standard survey area, suggesting that future surveys that the standard survey area to Port Alfred remains appropriate. We are confident that the biomass estimates reported are a good reflection of the current status of the stocks.

Appendix A

Distribution and relative density of other shoaling pelagic and meso-pelagic fish species for which densities could reasonably be derived, either through the appearance of their echoes in characteristic layers or through their co-incident occurrence in trawl samples.





Appendix B

Biomass and time series graph of meso pelagic fish

Year	Lantern Fish		Light fish	
	Biomass (tonnes)	CV	Biomass (tonnes)	CV
Nov-06	471319.78	0.283	1231669.26	0.152
Nov-07	601631.20	0.138	260162.14	0.237
Nov-08	739757.34	0.297	775539.34	0.310
Nov-09	1658221.37	0.323	335309.87	0.185
Nov-10	188554.37	0.466	524587.96	0.243
Nov-11	213223.35	0.312	809601.67	0.257
Nov-12	20935.97	0.813	523894.64	0.112
Nov-13	282877.73	0.549	1709819.48	0.150
Nov-14	295460.90	0.422	431166.30	0.195
Nov-15	878538.81	0.401	1166319.88	0.175
Nov-16	299175.06	0.443	1121356.52	0.183
Nov-17	411763.67	0.447	309084.21	0.249
Nov-18	176567.58	0.430	710825.28	0.282

