South African data available for hake assessments

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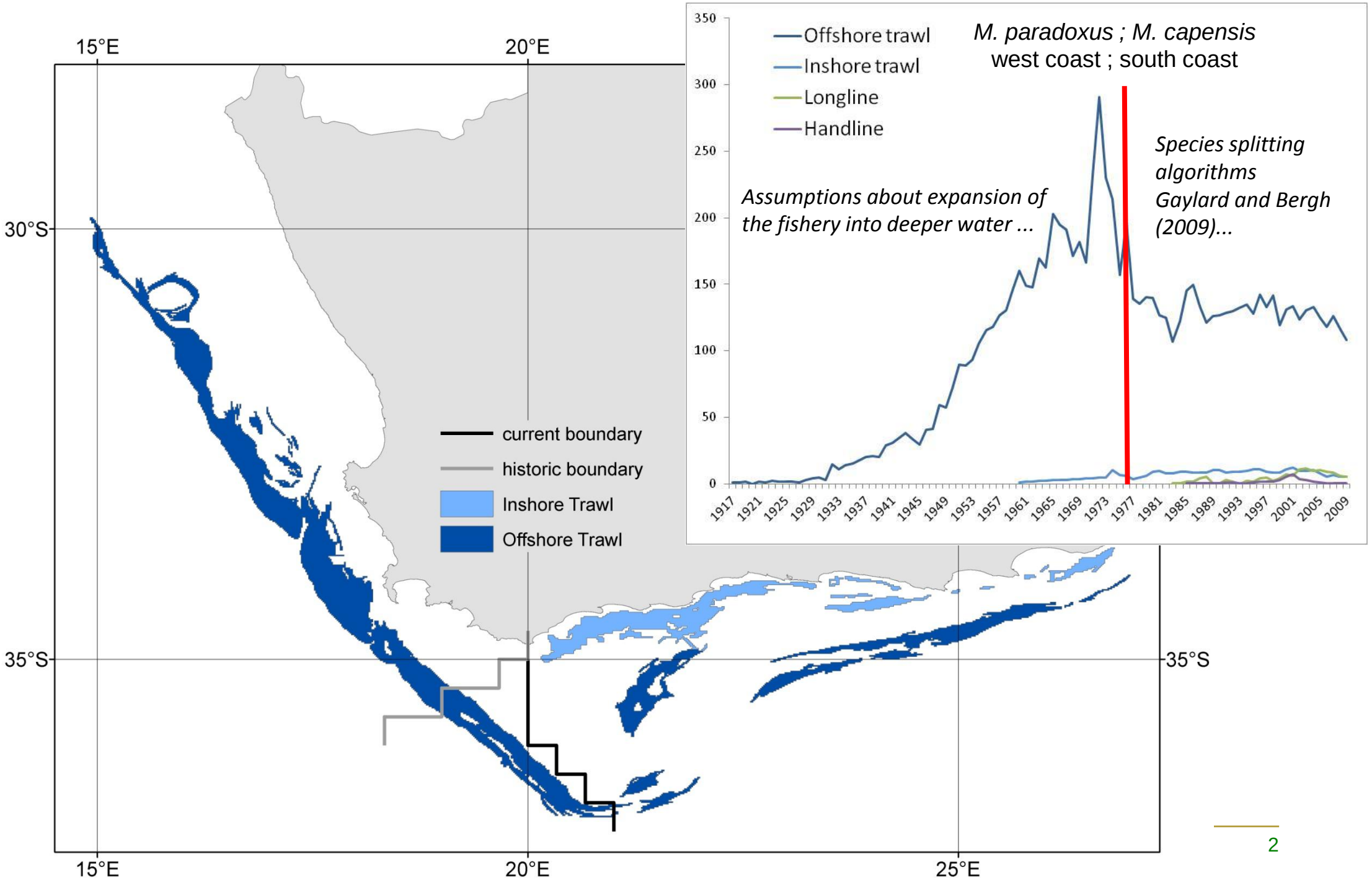
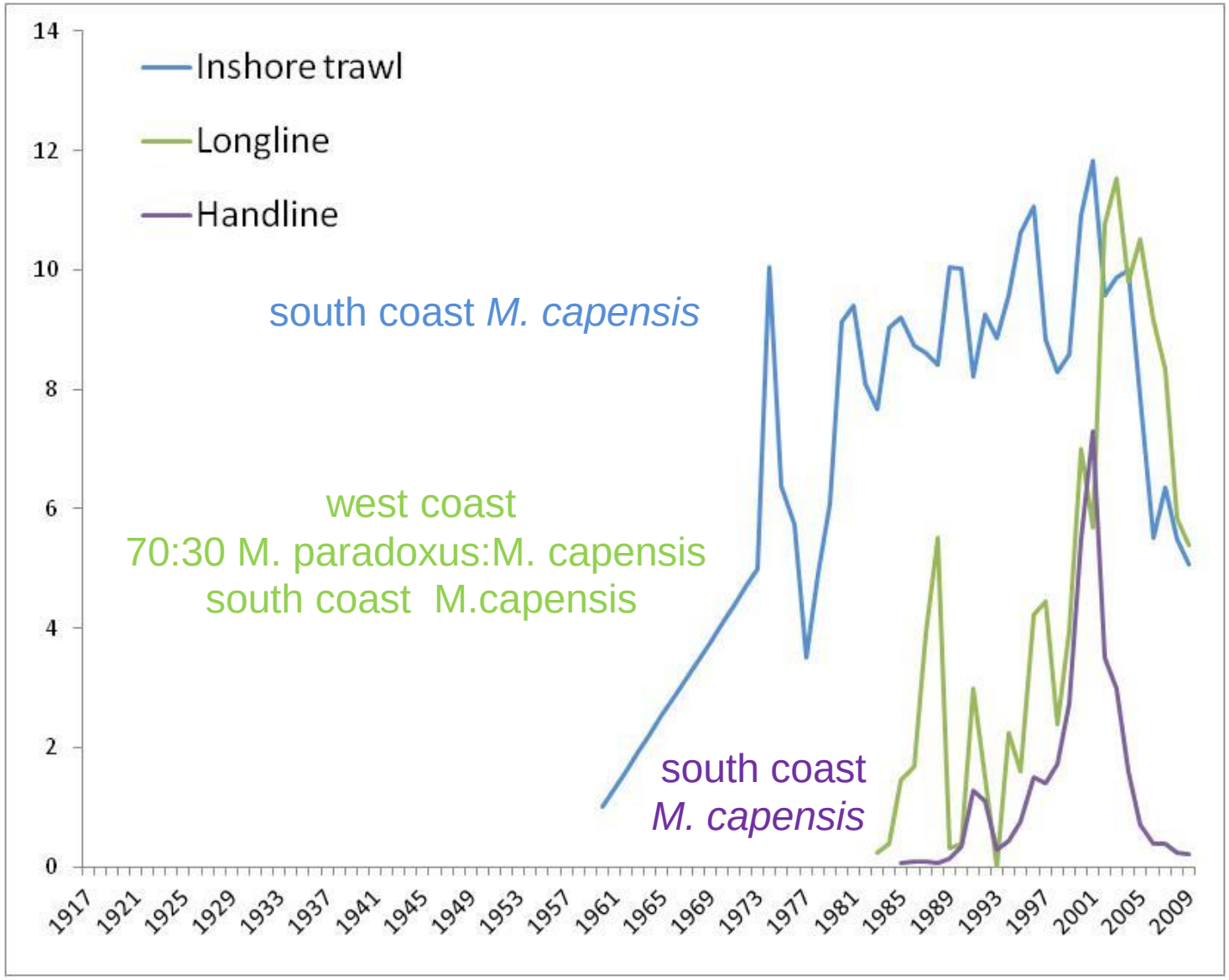
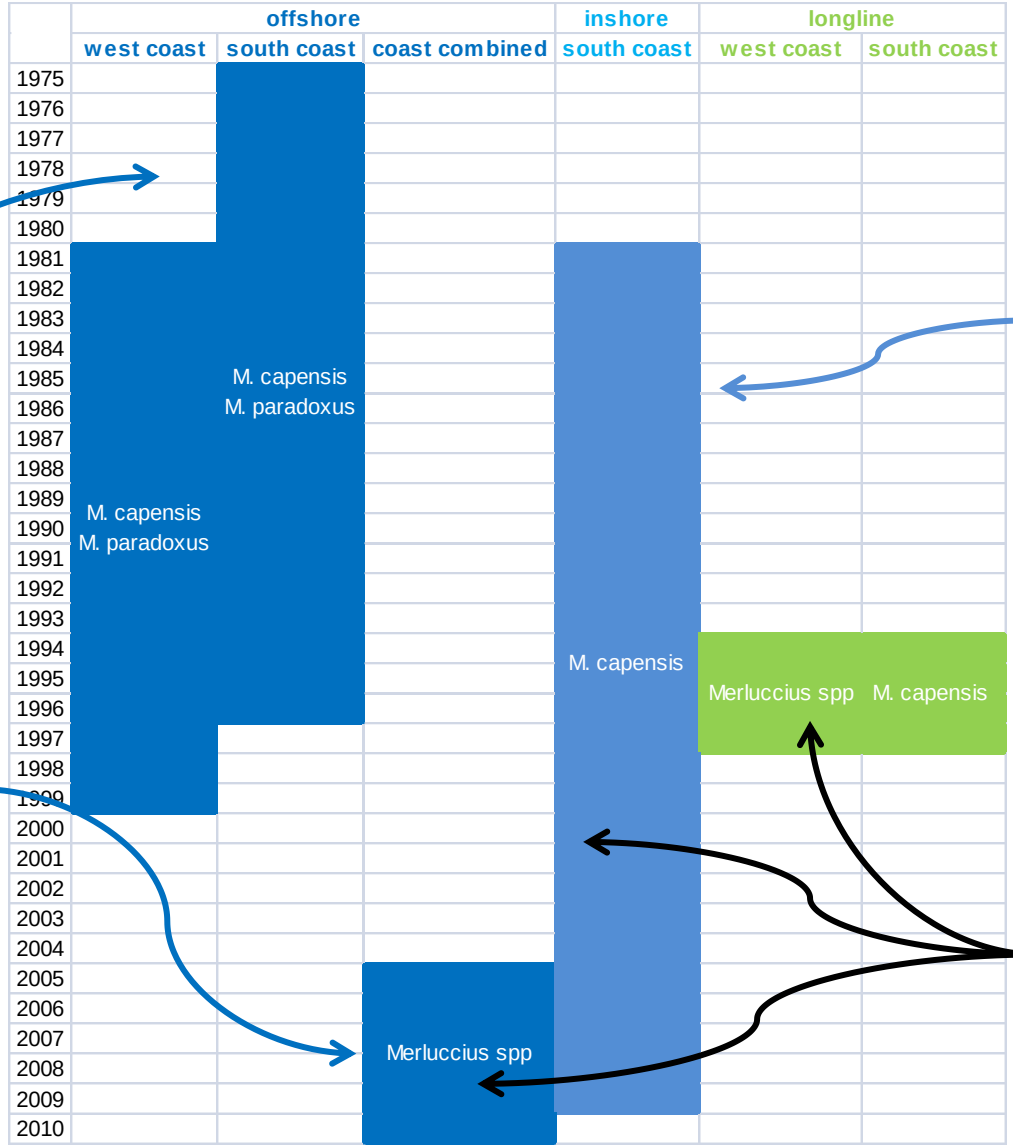
Annual Catch - offshore trawl



Annual Catch - inshore, longline…



Commercial catch-at-length



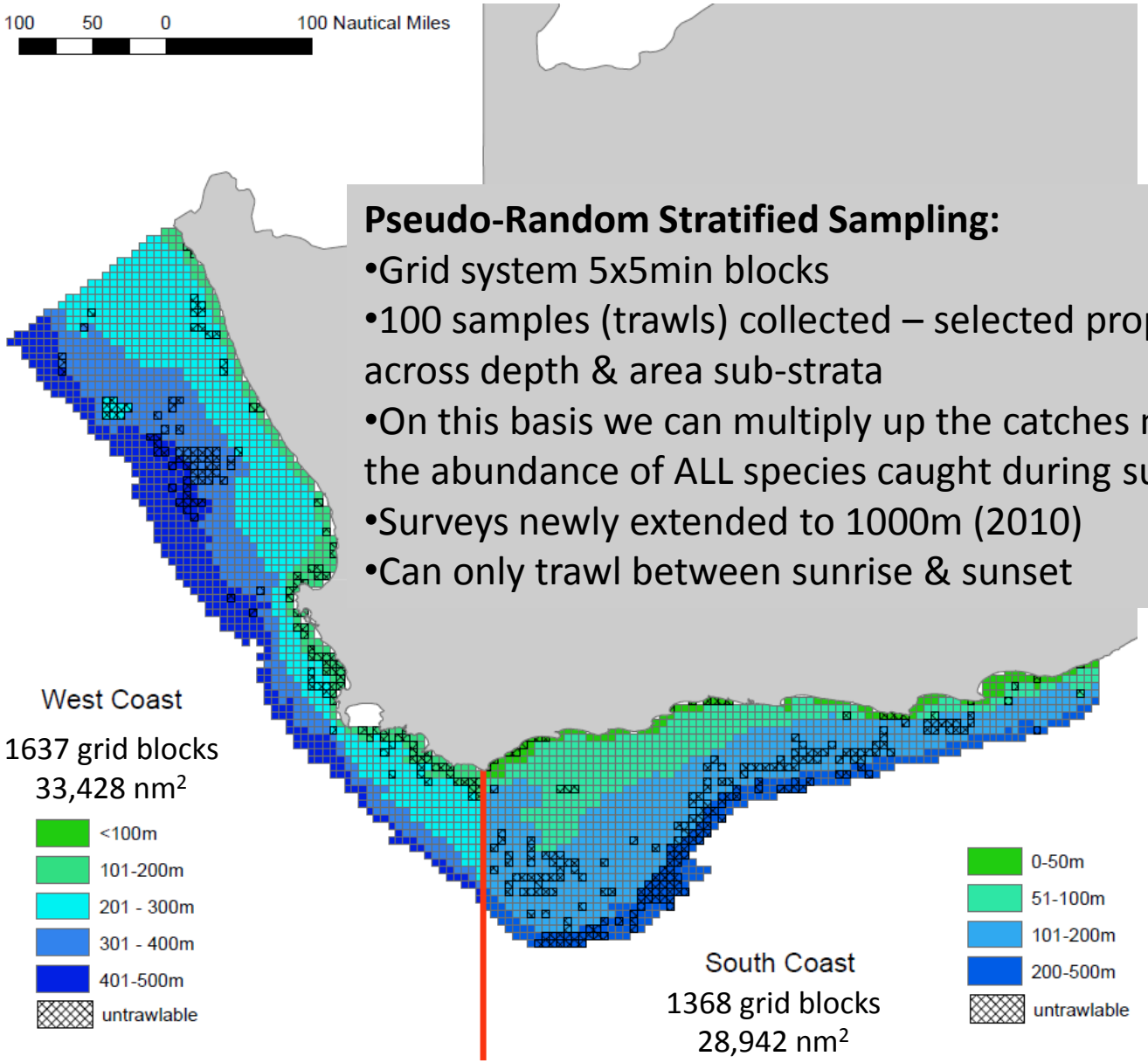
Length structure per commercial size category collected at shore-based processing establishments. Annual catch per size category by company used to scale-up observed length structure for sampled companies. Length structure summed over size categories and sampled companies then scaled to total annual catch by coast.

Length structure per commercial size category collected at shore-based processing establishments. Observed length data scaled up to yield estimated length structure per individual landing. Estimated length structure summed over sampled landings and then scaled up to annual catch by inshore fleet.

Sea-based length frequency data collected by observers scaled up by annual catches.

Raw data cannot be provided as they were collected at company specific factories/landing sites and thus contain confidential information specific to those companies.

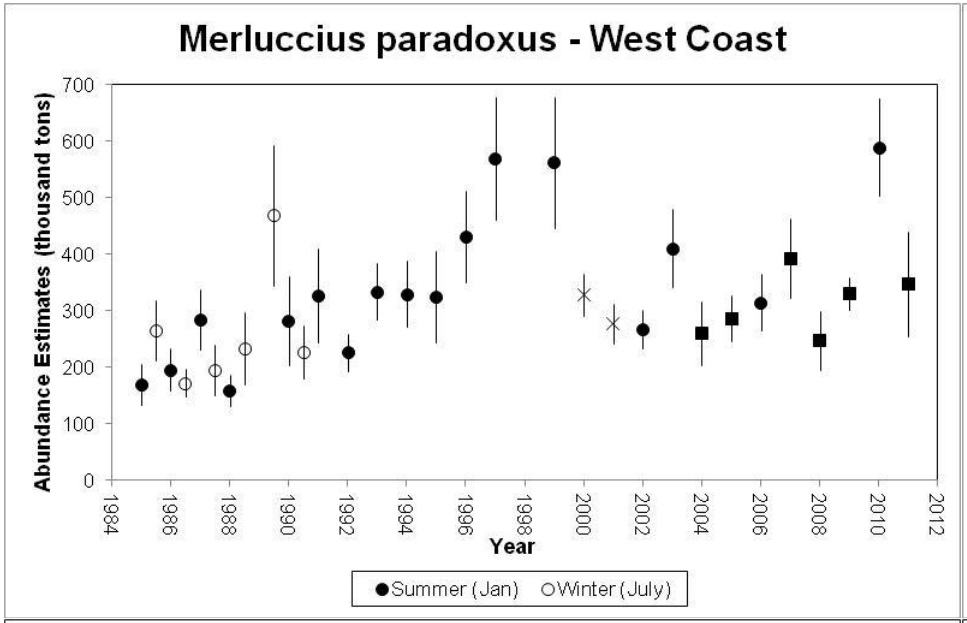
Demersal survey design

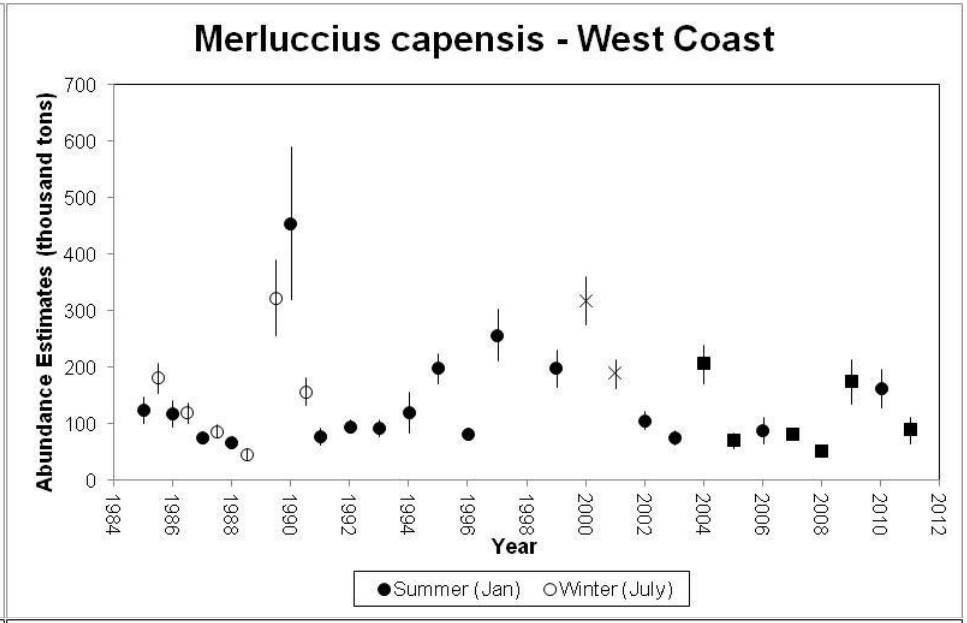


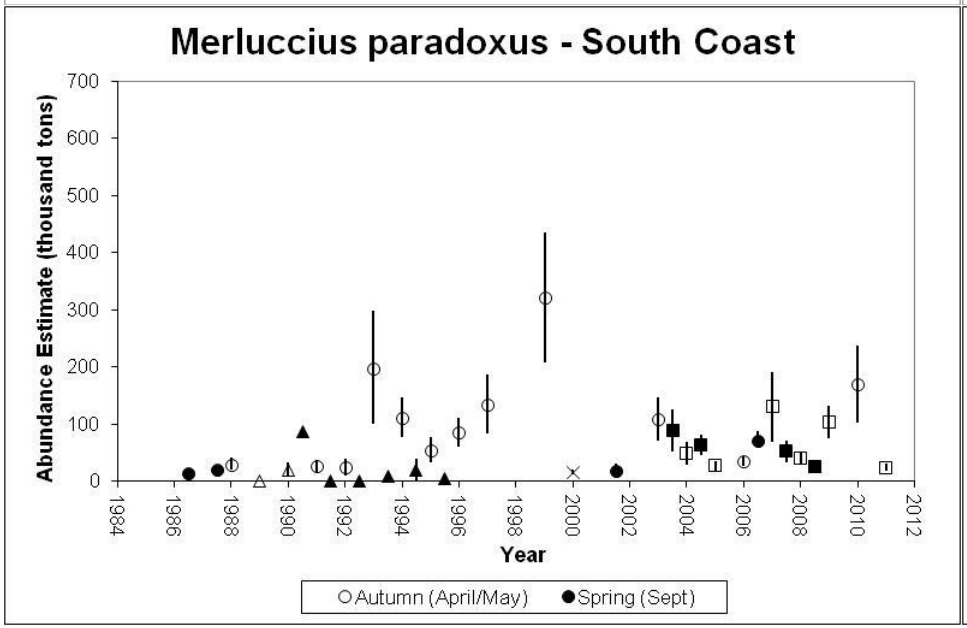
Pseudo-Random Stratified Sampling:

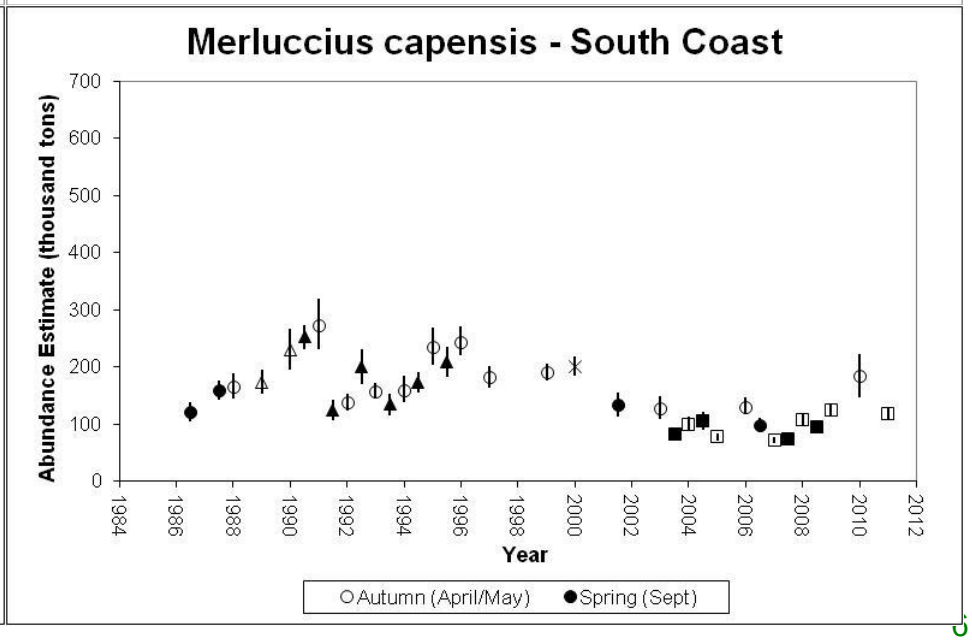
- Grid system 5x5min blocks
- 100 samples (trawls) collected – selected proportionate to across depth & area sub-strata
- On this basis we can multiply up the catches made to estimate the abundance of ALL species caught during surveys
- Surveys newly extended to 1000m (2010)
- Can only trawl between sunrise & sunset

Hake abundance estimates









Research length-at-proportion

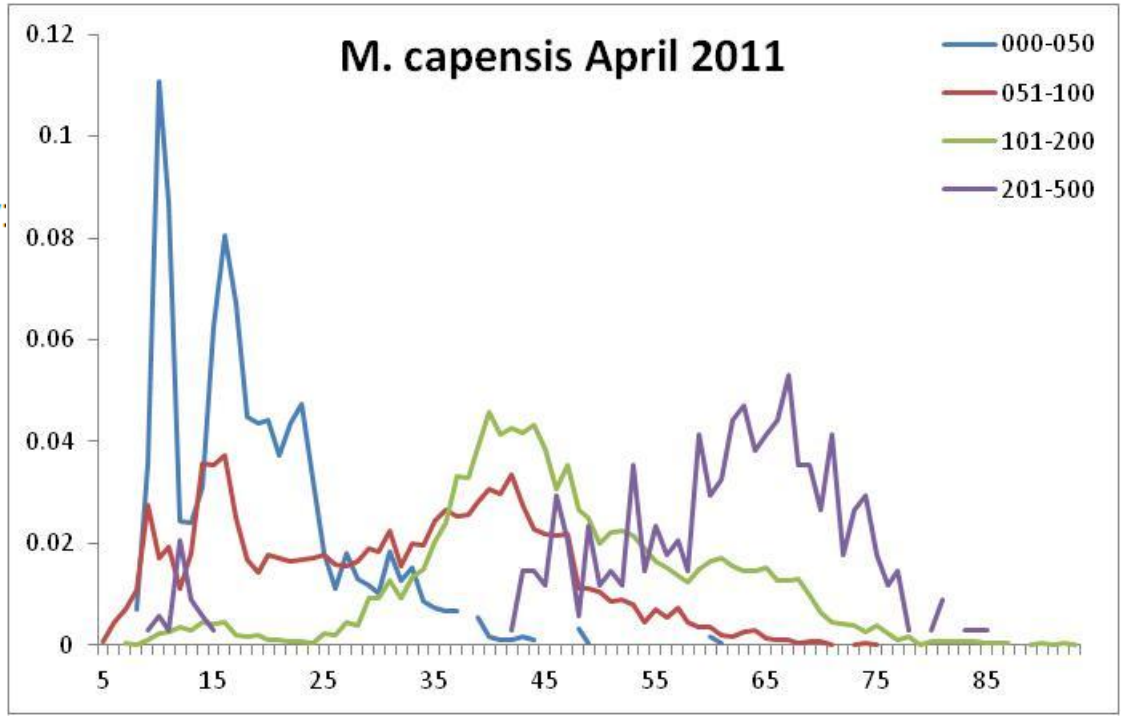
A random subsample of weight w_t^L of large fish is taken and the length distribution of the fish measured yielding $n_{t,l}^L$ fish of length group l; w_t^S of small fish yields $n_{t,l}^S$ fish of length group l and w_t^A of all fish yields $n_{t,l}^A$ fish of length group l.

The estimated number of fish of length group l in the whole trawl is then given by:

$$N_{t,l} = n_{t,l}^L \frac{W_t^L}{w_t^L} + n_{t,l}^S \frac{W_t^S}{w_t^S} + n_{t,l}^A \frac{W_t^A}{w_t^A}$$

The proportion of fish in a trawl t of length group l is given by:

$$P_{t,l} = N_{t,l} / N_t \text{ where } N_t = \sum_l N_{t,l}$$



Then for the stratum as a whole, $\tilde{P}_l$ is given by:

$$\tilde{P}_l = \frac{\sum_t \alpha_{t,l} P_{t,l}}{\sum_t \alpha_{t,l}}$$

Where $\alpha_{t,l} = n_{t,l}$ unless $n_{t,l} \geq 100$ in which case $\alpha_{t,l} = 100$ and $\sum_t \alpha_{t,l}$ is the sum of these altered $n_{t,l}$ values.

Research length-at-proportion by sex

For trawl t in length group l we sex $m^{L}_{t,l,m}$ males and $m^{L}_{t,l,f}$ females from the large fish, and similarly $m^{S}_{t,l,m}$ males and $m^{S}_{t,l,f}$ females from the small fish as well as $m^{A}_{t,l,m}$ males and $m^{A}_{t,l,f}$ females from the all fish for $l > 20$.

$$\left.\begin{aligned} m^{L}_{t,l,m} + m^{L}_{t,l,f} &\le n^{L}_{t,l} \\ m^{S}_{t,l,m} + m^{S}_{t,l,f} &\le n^{S}_{t,l} \\ m^{A}_{t,l,m} + m^{A}_{t,l,f} &\le n^{A}_{t,l} \end{aligned}\right\}$$

Note: because not every fish for which a length is measured is sexed.

The proportion of males in length group $l > 20$ in trawl t is estimated by:

$$q^{m}_{t,l} = \frac{m^{L}_{t,l,m}\frac{W^{L}_{t}}{w^{L}_{t}} + m^{S}_{t,l,m}\frac{W^{S}_{t}}{w^{S}_{t}} + m^{A}_{t,l,m}\frac{W^{A}_{t}}{w^{A}_{t}}}{m^{L}_{t,l,m} + m^{L}_{t,l,f}\ \frac{W^{L}_{t}}{w^{L}_{t}} + \ m^{S}_{t,l,m} + m^{S}_{t,l,f}\ \frac{W^{S}_{t}}{w^{S}_{t}} + \ m^{A}_{t,l,m} + m^{A}_{t,l,f}\ \frac{W^{A}_{t}}{w^{A}_{t}}}$$

For the stratum as a whole for $l > 20$ we split $\tilde{P}_{l}$ into male and female proportions using $q^{m}_{t,l}$ and $q^{f}_{t,l}$

Nansen Survey Data in SA waters

year	cruise	coast	season	purpose	start_station	end_station	start_date	end_date	fishboard name
2000	2000401	west	Summer	abundance cruise	28	144	20-Jan-00	12-Feb-00	NAN00001
2000	2000405	east	Autumn	abundance cruise	145	237	19-May-00	10-Jun-00	NAN00003
2001	2001401	west	Summer	abundance cruise	238	338	08-Feb-01	24-Feb-01	NAN00004
2002	2002401	west	Summer	transboundary	386	513	19-Jan-02	11-Feb-02	NAN00006
2003	2003401	west	Summer	transboundary	514	649	11-Jan-03	09-Feb-03	NAN00007
2004	2004403	west	Summer/Autumn	transboundary/intercalibration	650	805	06-Feb-04	08-Mar-04	NAN00008
2005	2005402	west	Summer/Autumn	transboundary	950	1108	06-Feb-05	09-Mar-05	
2006	2006402	west	Summer	transboundary/intercalibration	1152	1286	28-Jan-06	24-Feb-06	
2007	2007401	west	Summer	transboundary	1287	1390	11-Jan-07	03-Feb-07	
2008	2008401	west	Summer	transboundary	1420	1575	10-Jan-08	24-Feb-08	
2009	2009401	west	Summer	transboundary	1576	1754	08-Jan-09	17-Feb-09	
2010	2010401	west	Summer	transboundary	1	240	08-Jan-10	24-Feb-10	
2010	2010401	east	Summer	synoptic	2	100	08-Jan-10	27-Jan-10	
2011	2011401	west	Summer	transboundary	1	141	12-Jan-11	16-Feb-11	

Data on trawl, catch and length information was made available in early 2011.

Abundance estimates with error estimation can be calculated if the data is treated as if it was collected using a pseudo-random stratified design but this requires that the trawls be assigned to the demersal survey grid system.