

THE PRESENT AGREED HYPOTHESIS FOR SOUTH AFRICAN SARDINE STOCK STRUCTURE

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The South African sardine stock has recently been hypothesized to comprise multiple components, with putative western (distributed off the West Coast; *i.e.* to the west of Cape Agulhas), southern (distributed off the South Coast from Cape Agulhas to Port Alfred) and eastern (distributed off the South Coast in spring/summer and the East Coast in autumn/winter when they undertake the annual sardine run) components (or sub-stocks) suggested. The South African purse-seine fishery targets sardine off the West and South Coasts, although it may also catch fish from the putative eastern component when they are assumed to move back to the South Coast during spring/summer. Because of this, discussions relating to stock structure for management of the purse-seine fishery have considered only the putative western and southern sub-stocks, so that what follows relates to these two components only.

Confusion has arisen at times concerning hypotheses for sardine stock structure in the region where these two components occur, not least because the term “stock” can take on different meanings in the fisheries literature. Nevertheless there is in fact full agreement locally about the single hypothesis considered to apply for these components in that region, as set out below.

- Only one “stock” (in the sense of a reproductively isolated biological unit) is present, but there is spatial structure within this stock.
- The stock is considered to consist of two components: a western and a southern component. These have from time to time been termed stocks, sub-stocks or assemblages.
- The evidence for this is primarily:
 - a) Two main spawning areas which are widely separated spatially.
 - b) Differing parasite loads between fish from the western and southern components. These differences are considered to arise from a parasite endemic area (the area within which conditions for parasite transmission are suitable and all required hosts are present) confined to the West Coast (*i.e.* west of Cape Agulhas) only, with the presence of infected fish on the South Coast arising entirely from movement of infected sardine from the West to the South Coast.
 - c) Differences in some meristic (*e.g.* gill raker number) and morphometric (*e.g.* gill arch length, body shape) differences which are taken to be attributable to environmental effects (such as differences in temperatures off the two Coasts in areas where larvae develop into juvenile fish). Although these could reflect genetic differences, genetic studies (mitochondrial and microsatellite DNA) have not identified any west-south differences to date (genetic analyses using next generation sequencing are presently underway, but results are not yet available).

- There is movement between the two Coasts, (almost) exclusively west to south and at all ages post recruitment to the fishery. This movement is assumed to occur sometime between June and November.
- GSI values (indicators of spawning) are highest in sardine from the West Coast during spring and summer (August to February), whereas those for fish off the South Coast are highest in winter and spring (June to November). The relative quantitative importance of winter spawning by sardine off the South Coast is unclear.
- The assessment conducted divides the population into two components, west and east of Agulhas, and estimates movement of fish of ages 1 and above each year, though only in a west-to-south-direction (see Figure 1).
- This assessment indicates that in terms of recruits-per-spawner, the western component is much more productive than the southern component by about an order of magnitude.
- Within this agreed spatial structure, there remains one key uncertainty which is of particular importance in a management context. Some eggs spawned off the South Coast may be transported to the West Coast nursery area (Figure 1). What is unclear is the **extent** to which spawning biomass on the South Coast contributes to recruitment to the western component.

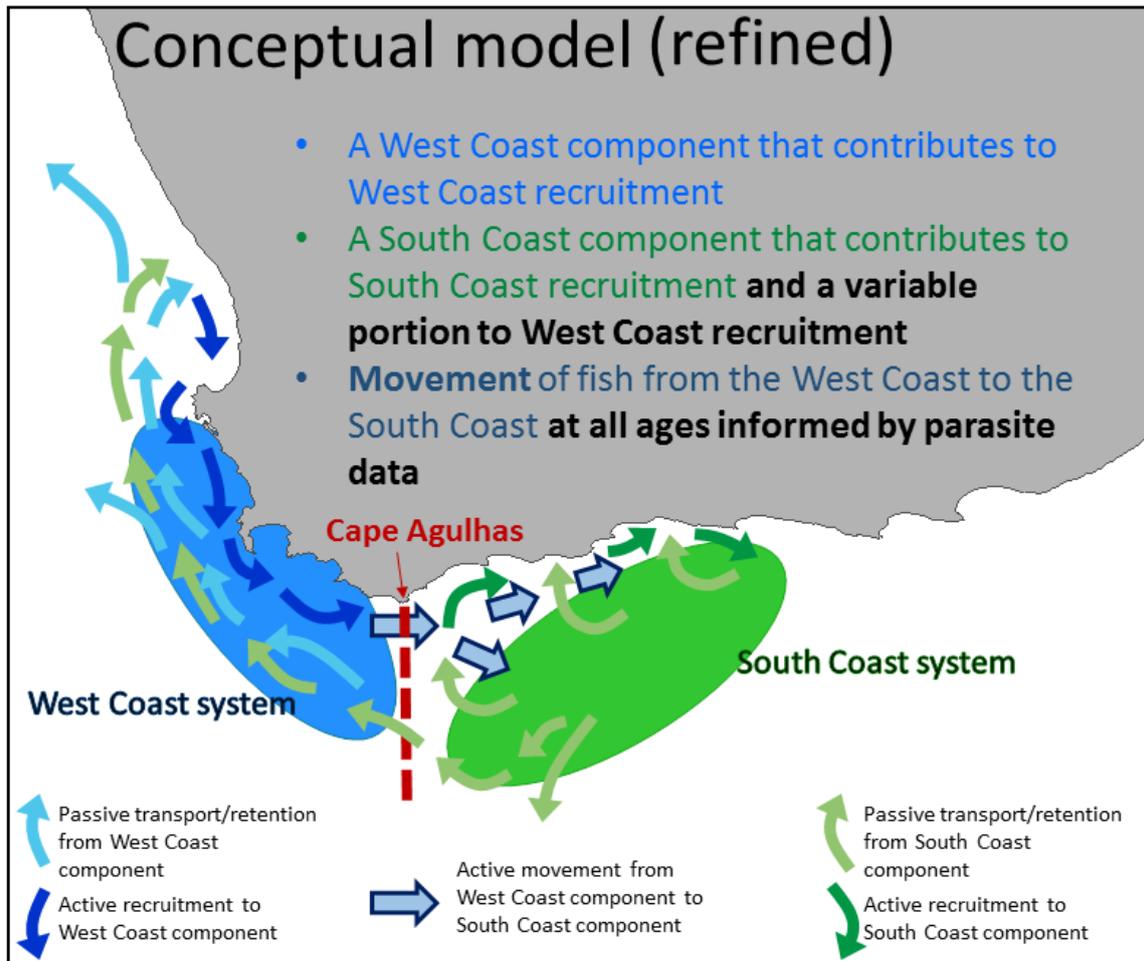


Figure 1: A conceptual model showing spawning grounds (ellipses) and passive (for early life history stages) and active (for recruit and older fish) movement of sardine from and between the hypothesized western and southern components.

