11 The Convergence Ecosystem in the Southwest Atlantic

C. Odebrecht and J.P. Castello

11.1 Introduction

The Atlantic subtropical anticyclone and the antarctic circumpolar current drive the upper oceanographic circulation in the Southwest Atlantic. The large-scale flow field comprises the south and northward flowing western boundary currents, the Brazil and Malvinas (=Falkland) currents, respectively. The Brazil Current transports warm tropical water (TW) during most of the year towards the southern Brazilian shelf (Garcia 1997), while the coastal branch of the Malvinas Current carries cool subantarctic water (SAW) northwards. The confluence of Brazil and Malvinas currents represents part of the subtropical convergence and the mixture of TW and SAW between about 25°S and 45°S forms the South Atlantic central water (SACW). The two currents outline the eastern boundary of a large marine ecosystem in the SW Atlantic between 23°S (Cabo Frio) and 55°S (Patagonia; Bisbal 1995; Fig. 11.1), separating it from the South Atlantic ocean basin. The western boundary of the confluence approaches the southern Brazilian, Uruguayan, and northeastern Argentinean coast, though latitudinal displacement occurs due to variability of the circumpolar antarctic current (White and Peterson 1996). As a consequence, high variability of physico-chemical and biological attributes occurs at the shelf and slope system between approximately 30°S and 40°S due to the influence of horizontal, vertical, and seasonal mixing processes among TW, SACW, SAW, and large continental runoff. High biological production conveys to this system importance as a nursery, feeding, and reproduction area for fishery stocks of both subtropical and antarctic origin, which utilize the western boundary currents for long distance transport (Castello et al. 1997). To comprehend the ecological variability of this warm transitional system (Boltovskoy et al. 1996), however, oceanographic processes within the larger ecosystem limits (23°S to 55°S) need to be considered.
Fig. 11.1. South Atlantic oceanographic circulation with main flows of Brazil Current (BC), Malvinas Current (MC), and the Subtropical Convergence (STC). Detailed map of the large marine ecosystem in the SW Atlantic between 23°S and 46°S. Shaded area approximately corresponds to the warm transition zone ecosystem

11.2 Environmental Setting

The regional climate is largely controlled by the latitudinal migration of the Atlantic anticyclone high-pressure center and the passage of polar fronts. Monthly mean air temperatures in July (winter) and January (summer) vary between 18 and 24°C in the north (30°S) and between 8 and 20°C in the south (40°S; Hoffmann et al. 1997; Klein 1997). The dominant winds are NE, followed by W-SW winds; however, their path and frequency varies strongly from year to year, owing to polar front passages (6–10 day