

through the rough and tumble of the overfall. These reflected waves then interact with the waves that are moving upstream, creating an untidy sea state with a proportion of steep, clapotic wave crests.

Currents versus longer waves

Stronger currents stop longer, faster waves. For instance, a 6 knot current will stop 24 knot waves, which have a wavelength of 100 metres, while a 9 knot current will even stop 36 knot waves with a wavelength of 225 metres (see Table 1 on page 32). Within my own home waters, currents of these magnitudes occur in several places, such as the infamous overfalls of the Alderney Race, Portland Race, Raz de Sein and Pentland Firth.

Foreshortening of longer waves creates particularly dangerous conditions because they can grow to greater heights before they become unstable and break. The Portland Race has, in the past, caused severe damage to a squadron of naval destroyers, while in the Pentland Firth armoured battleships have been known to imitate submarines, with their decks well under water. Off the south-east coast of Africa, the strong Agulhas Current collides head-on with waves that have

been formed in the Roaring Forties, resulting in seas that are big enough and steep enough to break the backs of large merchant ships.

Even if long, fast waves meet a relatively slow current and are not completely stopped, they become steeper and contribute to the roughness of the overfall. When the wave spectrum includes a mixture of short and long waves, the usual effect of an adverse current is to stop all the shorter, slower waves while allowing the longer, faster waves to continue moving forward slowly (see Fig 6.4). Immediately upstream of the stopping line, the longer waves have been slowed by the current, and are short and steep, but they look relatively smooth because the smaller waves have been wiped off the surface. Further upstream, if these long waves reach a zone of weaker current, they are able to regain speed and flatten out.

This scenario is quite common in the open sea, where the wave spectrum usually includes some long swell. In Photo 6.5 the fishermen in the motorboat are directly above a reef, just clear of the broken water of the overfall where short waves have been stopped, but they are rolling on the smooth undulations of longer waves that have pushed upstream, through the strong current.

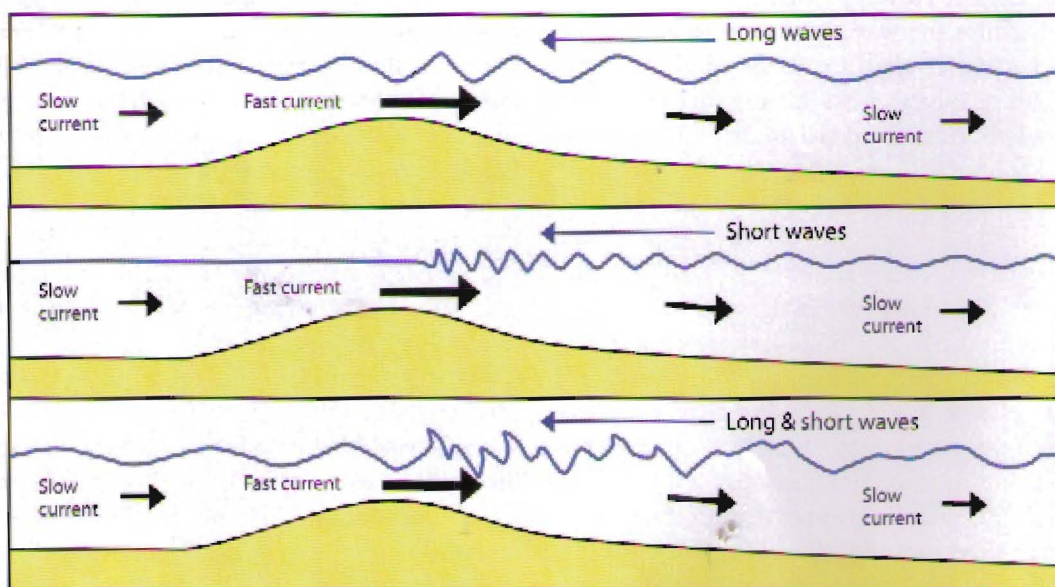


Fig 6.4 Overfalls at a shoal, with both long and short waves