Physical Oceanography of Cook Strait

D. M. Garner

Cook Strait affords the only direct communication between the differing oceanographic environments of the east and west coasts of New Zealand. The hydrological pattern is complex and the limited observations available permit only a generalized view to be presented. Some localized measurements over brief periods give an indication of this complexity. The interaction of the eastern and western hydrological regimes is at present best shown by the surface temperament/salinity distribution patterns. The average summer temperatures range from 64 deg. F. in the north-west to 59 deg. F. in the south-east and a well marked temperature discontinuity is generally found in the narrows. The average winter temperatures are 54 deg. F. in the north-west and 49 deg. F. in the south-east. The surface salinities follow the same pattern. If the discontinuity be interpreted as the boundary between waters of western and eastern affinities, its fluctuations are an index to the short term and seasonal variations in the interacting boundary zone between the two water types.

Indirect measurements of water movement in the southern Strait and the pattern of drift card recoveries indicate a nett movement south-east through the Strait along the northern shore. A possible equivalent northward nett flow along the southern coast is supported by only a portion of the available data.

The tidal currents are of an order greater than any suspected circulatory current. The range and phase varies in complex fashion over the Strait. Between Makara and Wellington a difference in phase of up to 5 hours has been observed and this apparently varies with the age of the moon.

While the broad pattern of distribution of water type remains reasonably constant the day to day pattern of total surface water movements varies continuously. Flow in the Strait is essentially turbulent and the surface water movements in the narrows persist to near the bottom without radical change in velocity.

Plankton

B. M. Bary

By and large the planktonic population of one water mass will differ from that of another either in the species present or in the composition of the population. Where several water masses are mixing the planktonic organisms collected at a point in the mixture will depend on which water masses are contributing towards the environment at that point. The relative abundance of the several populations may well be indicative of the proportions of the respective contributions and of the length of time since these were made.

The water in Cook Strait may be assumed to be a mixture of waters. The chief components probably are of subtropical and subantarctic origin. Water which enters the Strait from the Tasman Sea may differ from either of these. An extension of the East Cape Current, which reaches and is deflected into eastern Cook Strait at times, shows qualities indicating a tropical origin. Upwelling in and near the Straits may add yet another, different water.

Some, or all, of these waters could be present at one time. Each may introduce a

range of different species from those of the other waters. Thus in the Cook Strait area there are potentialities for a dynamic interplay. Water properties will vary as mixing proceeds, and the plankton populations will be in a state of flux as specimens from one water are introduced into conditions foreign to them, and from which some will be eliminated as a result of lack of adaptability.

Information about Cook Strait at present available does little more than outline the essentials of the situation. There is a small amount of evidence from zooplankton, chiefly from the distribution of copepods, amphipods and euphausiids, which indicates that there is some interplay between water masses, and that the zooplankton of the Straits is in fact dependent on the waters influencing the area at a particular time.

It is concluded that Cook Strait and its environs offer possibilities for fundamental studies. These would concern, firstly, the relationships of species and water masses, and the species' reactions when introduced into a water foreign to them; and secondly, whether species which are distinctive of each of several waters may not in fact demonstrate the locale and extent of mixing between the waters, and, through the proportions of the original populations surviving, the time which has elapsed since mixing began.

Sharks and Rays of Cook Strait

J. A. F. Garrick

From the ecologist's point of view, Cook Strait is a region of considerable value for the study of any marine group, because of the variety of physiographic and hydrographic features that are encompassed within a relatively small area. For an ecologist wishing to study the sharks and rays, Cook Strait is an even better proposition because at least 90% of the known New Zealand species occur in the area. This richness of the Cook Strait fauna as exemplified by the sharks and rays, is no doubt due in part to the variety of habitat, plus the fact that most sharks and rays are fairly tolerant of a wide range of habitat anyway.

However, before any ecological study can proceed far it is necessary that the animals concerned be known from a systematic point of view, and in the case of an ecological study of a whole group, that something more than the majority of them be known adequately in this respect.

The position with regard to the sharks and rays of Cook Strait (which for the purpose of this talk I am regarding as extending from about Castlepoint to Kaikoura on the eastern side) is that there is as yet insufficient knowledge of them for an ecological study to make very much progress. Too many species are known from an inadequate number of specimens — for example 10% are known from one specimen of each while a further 10% are known from four specimens or less. When we consider that the total number of New Zealand sharks and rays is only 45 this number of poorly known species is significant.

Moreover, the species on which we have so little information are not all deep-water species—at least four of them, *Heterodontus portus-jacksoni* (bull-head shark), *Triakis attenuata* (shovel-nosed smooth-hound), *Arrynchobatis asperrimus* (long-tailed skate) and *Dasyatis thetidis* (long-tailed stingray) have been taken in 100 fathoms or less, while several others have been caught no deeper than 200 fathoms.

If we now turn our attention to the common species, the identity of even some of these is not firm. An example in this category is the shallow water spiny dogfish from the western side of the Strait, *Squalus griffini*, which is regarded as an endemic, though critical comparison with overseas specimens may still prove it to be identical with the Atlantic *Squalus fernandinus*. Similarly the systematic status of our well-known big-game shark, the mako, awaits