

DISTRIBUTION AND HABITAT

Gobiomorphus huttoni is generally found in flowing water and has not been recorded from lakes. It has been found only in streams directly connected with the sea, and for this reason and others to be discussed in a later paper, larval life of *G. huttoni* is thought to be marine. Though juvenile and adult *G. huttoni* have high salt tolerance and survive prolonged immersion in sea water they have not been taken from the sea. The downstream range limit appears to be upper stream estuaries, generally in water flowing fresh at low tide but partially salt at other times.

G. huttoni is not found above stream barriers such as large falls, weirs, dams, etc. Where these barriers do not limit the range of the species, the upstream limit is ill-defined. Stokell (1955, p. 57) recorded maximal altitude as 300 feet and distance from the sea as eight miles. In the Makara Stream, the upstream limit was found to be 300 feet and about six miles from the sea, whilst comparable figures in the Waikanae River were 650 feet and 13 miles from the sea. In the Kahuterawa Stream, a tributary of the Manawatu River, Hopkins (pers. comm.) reported that *G. huttoni* was found at an altitude of about 400 feet and 55 miles from the sea. The factors limiting the range of *G. huttoni* have not been determined precisely. The juveniles migrate upstream from the sea at an age of four to six months, and in fresh water occupy the lowland reaches of the streams; the adults are found in the mid-reaches. It is probable that the upstream range of *G. huttoni* is dependent on the ability of the fish to penetrate the upper reaches of the stream, and the differences in the upstream range of *G. huttoni* in various streams are probably related to the severity of the stream gradient barriers encountered by the fish towards the upper limits of their range. The adult *G. huttoni* are probably absent from the sea for the same reasons that they are absent from lakes—preference for running water.

G. huttoni inhabits rapidly flowing streams and is found where the stream bed is composed of large rocks and boulders, where the stream bed is very open. Open boulder substrate construction is found where streams are changing from mountainous character to meandering lowland stream; in this transitional stream type, pools alternate with riffles. At the heads of the riffles, loosely aggregated boulders accumulate, and it is here that *G. huttoni* is most abundant, inhabiting the interstices of these boulder aggregations. In the pools above the riffles and in the riffle itself, the stream bed tends to be more compact and *G. huttoni* occurs less frequently.

Streams which provide typical *G. huttoni* habitat are immature streams which have narrow V-shaped valleys and little or no flood plain. *G. huttoni* is generally absent from maturer streams where the stream bed is more compact and is for this reason generally absent from the rivers of the Canterbury Plains. In these rivers *G. huttoni* is replaced by *G. basalis* and *Philypnodon breviceps*. The pattern of distribution of *G. huttoni* in a generalised immature stream is shown in Fig. 1.

Though the habitat described above is typical for *G. huttoni*, this species is not entirely limited to rocky streams. The lower reaches of the Makara Stream have a sand-gravel bed and there is a small resident population of *G. huttoni* present there throughout the year. Large numbers of females migrate downstream after breeding and are present in the lowland stream during the spring and summer. The adults in the lowland stream are found amongst stream vegetation and other cover, though mostly in the faster runs of water. The juvenile bullies also inhabit lowland streams. They may occupy cover (e.g., stream vegetation, grasses, overhanging the stream banks, stream debris, etc.) but they are not strongly cover-seeking in their habits and come freely on to the sandy-gravel shallows on the inner margins of stream bends.