

astonishing. Portions of the upper works of the steamer "Taranaki," which was sunk in Tory Channel on August 10th, 1868, and remained under water thirteen months, were so closely perforated that they could be broken by the fingers, and it was found unsafe to walk on the decks until they were covered with new planks. Mr. George informs me that in Wellington Harbour he has seen Quebec oak rendered useless in less than five months, and red birch used for staging piles was completely honeycombed in twelve months. In Auckland, blue gums piles, 15 to 20 inches in diameter, were attacked within six months of being driven, and eaten almost through in less than eighteen months. Unprotected manuka piles driven in 1871 are now seriously damaged, and in some cases almost useless. Small pieces of sappy timber have been honeycombed in a single month. I have seen substantial totara piles attacked within two years, but it is often exempt for three or four years, and resists the teredo for a longer period than any other New Zealand timber, except perhaps puriri. The substantial wharf at the Bluff Harbour, which was constructed less than ten years ago, is seriously injured. Fine totara piles drawn about three years ago were sparingly perforated almost to the centre, so that in three or four years more, extensive repairs will be necessary to preserve it from complete destruction, although the timber between the perforations is at present perfectly sound.

In Nelson, black birch piles are much injured in three years, and rarely last more than eight or ten years.

Puriri is the only New Zealand timber that I have never seen perforated by teredos, but it is very rare to find it used in marine situations where any part of it is continually submerged. I have seen it untouched amongst other timbers which have been attacked, although exposed to the air after the ebb of the tide. Pohutukawa is sometimes attacked, but I have never seen it perforated so much as three inches from the exterior. Matai has considerable power of resistance, but not nearly equal to totara. Kauri, especially if sappy, is speedily destroyed, but I have seen heart of kauri exposed four years without being attacked.

A remarkable fact connected with the operations of the teredo is that it lacks the power to bore through bark. I have never seen a perforation made through the bark of any timber. Mr. D. E. McDonald, engineer to the Auckland Harbour Board, informed me that he had never seen bark perforated by teredines. Mr. Akerson, of Nelson, considers that piles of black birch driven with the bark intact will last three years longer than if without the bark. A small piece of a branch picked up in Wellington Harbour shows this peculiarity in a marked form: it is closely perforated from the fractured ends only, the bark being untouched. I have deposited the specimen in the Colonial Museum. Unhappily, the advantage to be derived from this peculiarity are extremely limited, except perhaps in some protected works. After a brief maceration, small particles of the bark are easily detached by the friction of boats, floating timber, and a variety of causes, so that the mollusc, which commences its operations when it is no larger than a pin's head, readily gains access, and burrows in the greatest security.

In large piles the tubes are bored upwards, and in the direction of the grain, although they often turn abruptly at a right angle. Piles are never perforated below the ground level: in fact, where either mud or sand is awash, teredines cannot exist. I believe the borings in some instances extend to within two feet of high water-mark. The external apertures are occasionally seen in situations where the tide has access to them for not more than four hours at each flow; but, as might be expected, the animals and their tubes are but small. In the case of the "Taranaki," their operations were carried on at a depth of 105 feet, the greatest depth, I believe, at which true teredines have been known to work.

The largest tubes I have seen were excavated in totara piles at the Bluff Harbour, but the perforations in each pile are not nearly so numerous as would be seen in Wellington or Auckland. In small pieces of timber, the perforations are so numerous that the tubes are frequently in contact, when the animal is small and short lived.

As a rule, they are extremely careful not to bore into each others' tubes. I never saw an instance of cross perforation in Auckland, but at Port Chalmers and the Bluff, several examples came under my notice. Unfortunately, I was unable to obtain perfect shells of the southern form, but coupling this unusual habit with a peculiarity in the boring of the tubes, it seems not unlikely that the southern form is distinct from the northern.

I have already stated that the timber between recent perforations is perfectly sound, but in most cases the interspaces speedily become disintegrated. A small boring crustacean, *Linnoria lignorum*, Rathke, takes possession of the abandoned tubes as soon as portions of the shelly lining become detached, and by countless thousands of small perforations, scarcely one of which is of greater diameter than a stout pin, reduces the timber to a mere mass of spongy tissue, which is gradually broken up and washed away by tidal action, until at length the pile becomes so eroded that it is broken on the application of the slightest force. Although, unaided, the *Linnoria* can perforate the hardest wood, yet it seems unable to work at any great distance from the surface of the timber until the solidity of the pile has been broken by the perforations of the teredo, when it seizes upon the abandoned borings, and performs its work so effectually that in some instances almost every particle of ligneous tissue is removed from the interspaces, and the remains of the shelly linings are left exposed.

Numerous methods have been proposed for arresting the ravages of this most destructive animal. At present, the only effective plan has been to protect the parts exposed with copper sheathing, but this must be most carefully attached, as the young teredo commences his work when no larger than a pin's head, so can obtain access through a very small opening. Piles imperfectly sheathed were driven in the Auckland Wharf in 1865 or 1866, but were so greatly injured as to require renewal in 1872 or 1873. I believe all new piles are protected by sheathing, and examined by divers after they are driven.

Covering the piles with brushwood is said to have been tried in Europe with success, but the process involved such continuous attention that it was abandoned. Saturation with creosote and metallic compounds has been tried in vain as a preventative against both teredo and linnoria. It has been proposed to infiltrate harbour piles with silicate of lime, but the expensive nature of the process has