Tuhinga 15: 121–124

First record of an anomalous mullet fish (*Mugil cephalus*) from New Zealand

Laith A. Jawad

Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington, New Zealand (laithj@tepapa.govt.nz)

ABSTRACT: Skeletal deformities in a mullet fish, *Mugil cephalus* Linnaeus, 1758 (Mugilidae: Perciformes), are reported from New Zealand for the first time. Deformities involve the last three thoracic and the first caudal vertebrae. Adverse environmental factors, such as chemical pollution of the habitat, are believed to be the cause of such deformities.

KEYWORDS: skeletal deformities, mullet, *Mugil cephalus*, environmental pollution, New Zealand.

Introduction

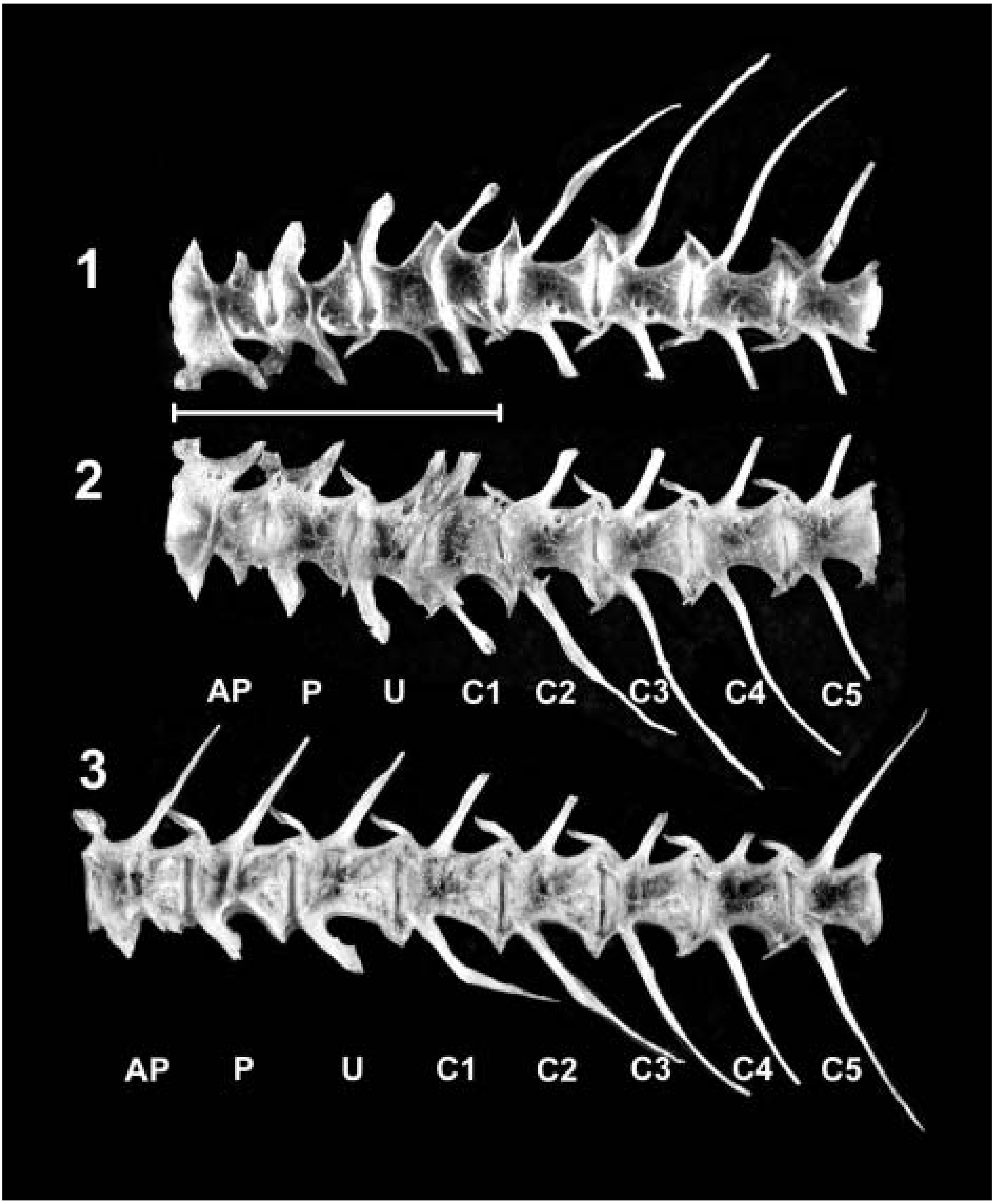
Since the pioneering works of Dawson (1964, 1966, 1971), there have been a number of reports on certain fish deformities (Al-Hassan 1983, 1985; Sinderman 1990; Brown & Nuñez 1998; Jawad 2002). In New Zealand, there have been no special studies of fish anomalies, with the exception of a few cases of skeletal deformities in several triplefin fishes (Tripterygiidae) (Hardy 1984, 1986, 1987a, b, c), which were superficially described. In this paper, I describe and illustrate the skeletal deformities observed in a mullet fish from New Zealand.

Materials

Two fish specimens of mullet fish, *Mugil cephalus* Linnaeus, 1758 (family Mugilidae, order Perciformes), were obtained from a commercial fish shop at Auckland, New Zealand, in 1997. One of these specimens showed deformed vertebrae. This specimen has been preserved as a skeleton and deposited in the Museum of New Zealand Te Papa Tongarewa (registration number: NMNZ P.39885), together with the skeleton of the normal specimen shown in Fig. 3.

Description of deformity

The deformed specimen described here is the first record of an anomaly for this commercially important species in the world. Deformities involve the last three thoracic vertebrae and the first caudal vertebra *(see* Figs 1 and 2). On the right side of the fish (*see* Fig. 1), the anterior and posterior parts of the antepenultimate thoracic vertebra (AP) are divided by a deep fissure; there is a deep, curved furrow between the anterior and posterior parts of the penultimate thoracic vertebra (P); the anterior surface of the ultimate thoracic vertebra (U) is deformed; and the anterior and dorsal sides of the first caudal vertebra (C1) are also deformed. On the left side of the fish (*see* Fig. 2), the antepenultimate thoracic vertebra (AP) has an enlarged anterior part and a broad neural spine base; the posterior part of the penultimate (P) and the anterior part of the ultimate (U) vertebrae are missing; and the first caudal vertebra (C1) lacks the anterior part and has a deformed dorsal part. There are also minor abnormalities in the haemal processes of the 2nd–4th caudal vertebrae (C1–C4), which are not parallel to each other, and the haemal spine of the 2nd caudal vertebra (C2) is wavy (*see* Figs 1 and 2).



Figs 1–3 Skeletal abnormality in *Mugil cephalus*: (**1**) abnormal specimen, right side; (**2**) abnormal specimen, left side; (**3**) normal specimen, left side (abbreviations: AP, antepenultimate thoracic vertebra; P, penultimate thoracic vertebra; U, ultimate thoracic vertebra; C1–C5, 1st–5th caudal vertebrae. White line defines limits of abnormal area).

Discussion

Abnormalities in fishes can have various causes, but are usually considered to originate from mutations and from teratogenic effects of adverse environmental factors, such as mutagenic chemicals in the water (Longwell *et al.* 1992, Lien 1997), on developing embryos and young individuals (Brown & Nuñez 1998, Vogel 2000).

It seems likely that adverse environmental factors such as chemical pollution of the habitat may have played a role in producing skeletal abnormalities in the *Mugil cephalus* specimen. The commercial landings of *M. cephalus* for the Auckland market mainly come from Kaipara Harbour, Manukau Harbour, and Rangaunu Bay (McKenzie *et al.* 1999), where recorded levels of certain pollutants might have a direct effect on the developing stages of fishes (Zauke *et al.* 1992, Williamson *et al.* 1995, Williamson *et al.* 1996, Auckland Regional Council 2001).

The main source of pollution in Kaipara and Manukau harbours is likely to be storm-water runoff from roofs and roads, which is generally discharged into streams, coastal lake waters, and aquifers. The discharge usually contains lead, zinc, and copper from vehicle brake linings, as well as cadmium from tyres and carcinogenic by-products from petrol and oil (Snelder 1995, Wilson 1999). Storm water from rural areas also carries persistent organic pollutants such as the pesticide DDT, which has been implicated as a cause of skeletal deformities in other fish species (Bengtson *et al.* 1985). Several flounders caught in urban and industrial sites showed impaired health, including liver lesions (Wilson 1999).

Other causes of fish deformities might include environmental factors such as water temperature (Milton 1971), dissolved oxygen (Turner & Farley 1971), or parasite infestations (Brown & Nuñez 1998).

Vertebral deformities such as those reported here in *Mugil cephalus* may affect the biology of the fish indirectly through inhibiting its free-swimming movements (Sadler 1990). An increased incidence of skeletal deformities among commercial fish species would suggest environmental deterioration and hence signal the need for prompt remedial action.

Acknowledgements

I would like to thank Bruce Marshall and Raymond Coory, both of the Museum of New Zealand Te Papa Tongarewa, respectively, for continuing advice and suggestions in the preparation of this manuscript, and for technical help in preparing the figures. I also thank two anonymous referees for their improvements to the manuscript.

References

Al-Hassan, L.A.J. (1983). Vertebral anomalies in *Mesopotamichthys sharpeyi* and *Carasobarbus luteus* (Pisces: Cyprinidae) from Basrah, Iraq. *Cybium* 7: 7–10.

Al-Hassan, L.A.J. (1985). Vertebral anomalies in *Gambusia affinis* (Teleostei: Poeciliidae) collected from Basrah and Baghdad, Iraq. *Pakistan Journal of Zoology* 17: 169–71.

Auckland Regional Council (2001). Kaipara River catchment water allocation strategy. *Technical Publication* 146: 1–122.

Bengtson, B.E., Bengtson, A., and Hinberg, M. (1985). Fish deformities and pollution in some Swedish waters. *Ambio* 14: 32–5.

Brown, C.L. and Nuñez, J.M. (1998). Disorders of development. In: Leatherland, J.F. and Woo, P.T.K. (eds). *Fish Diseases and Disorders. Vol. 2*. Oxon: CABI Publishing. 340 pp.

Dawson, D.C. (1964). A bibliography of anomalies of fishes. *Gulf Research Reports* 1: 308–99.

Dawson, D.C. (1966). A bibliography of anomalies of fishes. *Gulf Research Reports* 2: Suppl. pp. 169–76.

Dawson, D.C. (1971). A bibliography of anomalies of fishes. *Gulf Research Reports* 3: 215–39.

Hardy, G.S. (1984). A new genus and species of triplefin (Pisces: Family Tripterygiidae) from New Zealand. *Records of National Museum of New Zealand* 2: 175–80.

Hardy, G.S. (1986). Redescription of *Gilloblennius* Whiley and Phillips, 1939 (Pisces: Tripterygiidae), and description of a new genus and two new species from New Zealand. *Journal of the Royal Society of New Zealand* 16: 145–68.

Hardy, G.S. (1987a). A new genus for *Tripterigium dorsale* Clarke, 1879, an unusual triplefin (Pisces: Tripterygiidae) from New Zealand. *Journal of the Royal Society of New Zealand* 17: 157–64.

Hardy, G.S. (1987b). Revision of *Notoclinops* Whitley, 1930 (Pisces: Tripterygiidae), and description of a new species from New Zealand. *Journal of the Royal Society of New Zealand* 17: 165–76.

Hardy, G.S. (1987c). Revision of some triplefns (Pisces: Tripterygiidae) from New Zealand and Australia, with descriptions of two new genera and two new species. *Journal of the Royal Society of New Zealand* 17: 253–74.

Jawad, L.A.J. (2002). A record of fish anomalies from Benghazi area, Libya. *Teratology* 65: 1–2.

Lien, N.T.H. (1997). Morphological abnormalities in African catfish *Clarius gariepinus* larvae exposed to Malathion. *Chemosphere* 35. pp. 1475–86.

Longwell, A.C., Chang, S., Hebert, A., Hughes, J.B., and Perry, D. (1992). Pollution and developmental abnormalities of Atlantic fishes. *Environmental Biology of Fishes* 35: 1–21.

McKenzie, J.L., Parel, L., Maolagain, C.O., and Parkinson, D. (1999). Length and age composition of commercial grey mullet landings from the west coast set net fishing (GMU1), 97–98. *NIWA Final Research Report for Ministry of Fisheries. Research Project GMU9701* Objective 2. 15 pp.

Milton, J.B. (1971). Meristic abnormalities in *Fundulus heteroclitus*. *Technical Report No. 9. Marine Science Research Centre, State University of New York*. 34 pp.

Sadler, T.W. (1990). *Langman's Medical Embryology*. 6th edn. Baltimore: Williams & Wilkins. 411 pp.

Sindermann, C.J. (1990). *Principle Diseases of Marine Fish and Shellfish. Vol. 1*. 2nd edn. San Diego: Academic Press. 521 pp.

Snelder, T. (1995). The environmental impacts of urban stormwater runoff. *Auckland Regional Council Technical Publication* 53: 1–96.

Turner, J.L. and Farley, T.C. (1971). Effects of temperature, salinity and dissolved oxygen on the survival of striped bass eggs and larvae. *California Fish and Game* 57: 268–73.

Vogel, G. (2000). Zebrafish earns its stripes in genetic screens. *Science* 288: 1160–1.

Williamson, R.B., Krijnen, J.M., and Dam, L.V. (1995). Trace metal portioning in bioturbated, contaminated, surficial sediments from Mangere Inlet, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 29: 117–30.

Williamson, R.P., Dam, L.V., Bell, R.G., Green, M.O., and Kim, J.P. (1996). Heavy metal and suspended sediment fluxes from a contaminated, intertidal inlet (Manukau Harbour, New Zealand). *Marine Pollution Bulletin* 32: 812–22.

Wilson, T. 1999. Catchment 22. *Metro*. 214: 53–9.

Zauke, G.P., Harms, J., and Foster, B.A. (1992). Cadmium, lead, copper, and zinc in Elminius modestus Darwin (Crustacea: Cirripedia) from Waitemata and Manukau Harbours, Auckland, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 26: 405–15.