**S23 Table. Field and laboratory studies on responses of biomarkers of effect in fish to metals and other contaminants: histopathology and gross indices.** Most studies measured contaminants in the environment in addition to those identified as of concern for Gladstone Harbour (Al, Cd, Cu, Ga, Pb, Se, Zn); these are also presented for completeness.

| Species | LHS | Laboratory or Field | Metals | Other contaminants | HA | HIS/ LSI | GSI | CF | K index | RNA:DNA ratio | TLC | Other | Reference |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Acanthopagrus latus*  | A | Field sed | As, Cr, Cu, Ni, Pb, V, Zn | PAHs |   | - |   | = |   |   |   |   | (1) |
| *Anguilla anguilla* | Glass eels | Field sed | Cd, Cr, Cu, Hg, Ni, Pb, V, Zn | PAH |   |   |   |   | = |   |   |   | (2) |
| *Anguilla anguilla* | Yellow eels | Field sed | Cd, Cr, Cu, Hg, Ni, Pb, V, Zn | PAH |   |   |   |   | - |   |   |   | (2) |
| *Aphanius fasciatus* | A | Field water and sed | Cd, Cu, Zn | PAHs  |   |   |   |  +/- |   |   |   |   | (3) |
| *Aphanius fasciatus* | J | Field sed | Cd, Cd, Cu, Cu, ZnZn | PAHs |  + (Collagen) |   |   |   | = |   |   | COL1A2 +/- | (4) |
| *Aphanius fasciatus* | J | Lab water toxicity test | Cd |   |   |   |   |   |   |   |   | COl1A2 - | (4) |
| *Atherina presbyter* | A | Field sed | Cd, Hg, Ni, Pb, Zn | PAHs |   |   |   |   | = |  +/- |   |   | (5) |
| *Atherinops affnis* | L | Lab water toxicity test | Cd |   |   |   |   |   |   |   |   | Food intake - | (6) |
| *Centropomus parallelus* | J | Field sed and water | Ag, Al, As, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, Zn |   | = |   |   |   |   |   |   |   | (7) |
| *Chanos chanos* | A | Field sed and water | Cd, Cu, Fe, Mn, Pb, Zn |   | + |   |   |   |   |   |   |   | (8) |
| *Coris julis* | A | Field sed | Cd, Co, Cr, Cu, Ni, Pb, Sb, Zn |   | + |   |   |   |   |   |   |   | (9) |
| *Cynoglossus arel* | A | Field sed | As, Cr, Cu, Ni, Pb, V, Zn | PAHs |   | = |   | = |   |   |   |   | (1) |
| *Dicentrarchus labrax* | A | Caged field sed | Cu, Pb, Zn | PAHs |   | - |   |   |   |   |   |   | (10) |
| *Dicentrarchus labrax* | A | Field sed | Cr, Cu, Ni, Pb, Zn | PAHs |   |   |   |   |   | - | - | TPC -;  | (11) |
| *Dicentrarchus labrax* | J | Caged field sed | Al, Cd, Cr, Cu, Mn, Ni, Pb, V, Zn |   |   |   |   |   | - | - |   | Growth index -; TAG:ST - | (12) |
| *Dicentrarchus labrax* | J | Lab field sed toxicity | As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, V, Zn |   | + |   |   |   |   |   |   |   | (13) |
| *Dicentrarchus labrax* | J | Lab water toxicity test | Cd |   |   |   |   |   |   |   |   | Lateral line tissue + | (14) |
| *Epinephelus coioides* | J | Lab water toxicity test | Cu |   | + |   |   |   |   |   | - | Digestive enzymes -; TSFA +; MFA +; TPFA -;  | (15) |
| *Fundulus heteroclitus* | A | Field and lab sed | Cd, Cu, Hg, Pb, Zn | PAHs, PCBs |   |   |   |   |   |   |   | Prey capture -; | (16) |
| *Fundulus heteroclitus* | L | Field sed / lab | Cd, Cu, Hg, Pb, Zn | PAHs, PCBs |   |   |   |   |   |   |   | Prey capture -; | (17) |
| *Gadus morhua L.* | A | Cage field water | Cd, Cu, Hg, Pb, Zn | PAHs, PCBs  |   | = | = | = |   |   |   | SSI = | (18) |
| *Gadus morhua L.* | J | Lab water toxicity test | As, Cd, Co, Cr, CuHg, Mn, Ni, Pb, Zn | PAHs | = |   |   |   |   |   |   |   | (19) |
| *Galaxias maculatus* | E | Lab water and sed toxicity test | Cu, Pb, Zn |   |   |   |   |   |   |   |   | Phototactic response - | (20) |
| *Lates calcarifer* | A | Field sed | Cd, Cr, Cu, Ni, Zn | Diuron, PAHs |   | = |   |   | = | - |   |   | (21) |
| *Lates calcarifer* |   | Lab water toxicity test | Cu |   | + |   |   |   |   |   |   |   | (22) |
| *Limanda limanda* | A | Field sed | Cd, Cr, Cu, Hg, Ni, Pb, Zn | PAHs, PCBs | = |   |   | + |   |   |   | Parasites =;  | (23) |
| *Lutjanus russellii*  | A | Field sed and water | Cd, Cu, Fe, Pb, Zn |   |   | - |   |   |   |   |   |   | (24) |
| *Mugil cephalus* | A | Field sed and water | Cu, Fe, Mn, Pb, Zn |   | + |   |   | - |   |   |   |   | (25) |
| *Mugil cephalus*  | F | Lab water toxicity test | Pb  |   | + |   |   |   |   |   |   |   | (26) |
| *Mugil cephaus* | J | Field sed and water | Cd, Cu, Mn, Ni, Pb | AHCs, PAHs, PCBs, DDTs, TBT |   |   |   | = |   |   |   |   | (27) |
| *Mullus barbatus* | A | Field sed | As, Cd, Cu, Hg, Pb, Zn | PAHs, CBs, DDT, HCB, trans-nonachlor, Lindane, Dieldrin |   | = | - | - |   |   | - |   | (28) |
| *Plastichthys flesus* | A | Cage field water | Cd, Cu, Hg, Pb, Zn | PAHs, PCBs  |   | = |   | = |   |   |   |   | (18) |
| *Plastichthys flesus* | A | Field sed | Al, Cd, Cr, Cu, Fe, Hg, Mn, Pb, Zn | PCB,DDD,DDE, HCH |   |   |   |   |   |   |   | Parasites - | (29) |
| *Plastichthys flesus* | J | Field sed | Al, Cd, Cr, Cu, Hg, Mn, Ni, Pb, V, Zn | PAHs |   |   |   |   | - |   | - | TAG:ST - | (30) |
| *Plastichthys flesus* | J | Field sed | Al, Cd, Cr, Cu, Hg, Mn, Ni, Pb, V, Zn |   |   |   |   |   | - | - |   |   | (31) |
| *Plastichthys flesus* | J | Lab field sed toxicity | As, Cr, Cu, Hg, Ni, Pb, Zn | PAHs, DDT, HCB, CB, TBT, DBT |   |   | = |   |   |   |   |   | (32) |
| *Platichthys flesus* | A | Field sed | Cd, Hg, Pb, Zn | PAHs, PCBs |  + lesions | = |   |  +/- |   |   |   | Epidermal disease = | (33) |
| *Platichthys flesus L.* | A | Field water and sed | As, Cd, Cr, Cu, Hg, Ni, Pb, Zn | PAHs, PCBs, OCPs |  = | = | = | - |   |  +/- |   | TPC +\-;  | (34) |
| *Pogpmichthys macrolepidotus* | L | Lab food | MeHgSe |   | + |   |   | = |   |   |   |   | (35) |
| *Pomadasys hasta* | A | Field sed and water | Cd, Cu, Fe, Pb, Zn |   |   | - |   |   |   |   |   |   | (24) |
| *Pomatoschistus microps* | A | Field sed | Cd, Cr, Cu, Hg, Ni, Pb, Zn | PAHs |   |   |   |   | = | = |   |   | (36) |
| *Pomatoschistus microps* | A | Field sed | Cd, Hg, Ni, Pb, Zn | PAHs |   |   |   |   | = |  +/- |   |   | (5) |
| *Pomatoschistus microps* | A | Field sed | Cr, Cu, Ni, Pb, Zn | PAHs |   |   |   |   |   | - | = |  TPC +/- | (11) |
| *Scophtalmus maximus* | J | Caged field sed | Al, Cd, Cr, Cu, Mn, Ni, Pb, V, Zn |   |   |   |   |   | - | = |   | Growth index =; TAG:ST - | (12) |
| *Scophtalmus maximus* | J | Lab field sed | Al, Cd, Cr, Cu, Mn, Ni, Pb, V, Zn |   |   |   |   |   | - |  +/- |   | Growth index +\-; TAG:ST - | (37) |
| *Seriola lalandi* | J | Lab food | Se |   | = | - |   |   |   |   |   |   | (38) |
| *Solea senegalensis* | A | Field sed | Cr, Cu, Ni, Pb, Zn | PAHs |   |   |   |   |   |  +/- |  +/-  |  TPC +\- | (11) |
| *Solea senegalensis* | J | Field sed | Cd, Cr, Cu, Ni, Pb, Zn | PAHs |   |   |   |   | + |  +/- |   |   | (39) |
| *Solea senegalensis* | J | Lab and field sed | As, Cu, Zn | PAHs, PCBs, DDT | + |   |   |   |   |   |   |   | (40) |
| *Solea senegalensis* | J | Lab field sed toxicity | As, Cd, Cr, Cu, Hg, Ni, Pb, Zn | PAHs | + |   |   | + |   |   |   |   | (41) |
| *Solea senegalensis* | J | Lab field sed toxicity | Cd, Cr, Cu, Ni, Pb, Zn | PAHs, PCBs, DDT | + |   |   |   |   |   |   |   | (42) |
| *Sparus aurata* | J | Lab field sed toxicity | As, Cd, Cr, Cu, Hg, Ni, Pb, Zn | PAHs | + |   |   | + |   |   |   |   | (41) |
| *Squalus acanthias* | A | Lab water toxicity test | Pb |   |  |   |   |   |   |   |   | TPC liver +/-; glycogen muscle - | (43) |
| *Symphodus melops* | A | Field water and sed | Fe, Pb, Zn |   |   | = | - | = |   |   |   | SSI - | (44) |
| *Synechogobius hasta* | J | Lab water toxicity test | Cd |   | + | + |   | = |   |   | + | VSI = | (45) |
| *Terapon jarbua* | F | Lab water toxicity test | Pb |   | + |   |   |   |   |   |   |   | (26) |
| *Terapon jarbua* | J | Lab food | Cd |   |   |   |   | = |   |   |   |   | (46) |

Abbreviations: LHS: life history stage; A: adult, E: eggs, F: fingerlings, J: juvenile, L: larvae: Lab: laboratory; Sed: Sediment; HCB: hexachlorobenzene; OCP: total organochlorine pesticides; CB: chlorinated biphenyls; naph: naphthalenes; PAHs : total polycyclic aromatic hydrocarbons; PCBS: polychlorinated biphenyl; TBT: tributyltin; DBT: dibutytin; DDD: 1,1-dichloro-2.2-bis(p-chlorophenyl) ethane; DDE: 1,1-dichloro-2.2-bis(p-chlorophenyl) ethylene; HCH: hexachlorcyclohexane; DDT: dichlorodiphenyltrichloroethane; HCB: hexachlorobenzene; HA: histological alteration; HSI: hepatosomatic index; LSI: liver somatic index; GSI: gonadosomatic index; CF: condition factor; + induction; - inhibition; = no significant induction; +/- mixed response; TAG:ST - lipid storage index; TLC - total lipid content; TPC - total protein content; TPFA - total polyunsaturated fatty acids; MFA - monounsaturated fatty acids; TSFA - total saturated fatty acids; COL1A2: Collagen 1A2; VSI: viscerosomatic index; Vac: Vacuolation; Fibr: Fibrillar structures.

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