## Fish Ageing Precision Articles

27 November, 2018

Acre, M. R., C. Alejandrez, J. East, W. A. Massure, S. Miyazono, J. E. Pease, E. L. Roesler, H. M. Williams, and T. B. Grabowski. 2017. Comparison of the precision of age estimates generated from fin rays, scales, and otoliths of Blue Sucker. Southeastern Naturalist 16:215–224.

Adams, J., and D. Kerstetter. 2014. Age and growth of three coastal-pelagic tunas (Actinopterygii: Perciformes: Scombridae) in the Florida Straits, USA: Blackfin Tuna, *Thunnus Atlanticus*, Little Tunny, *Euthynnus Alletteratus*, and Skipjack Tuna, *Katsuwonus Pelamis*. Acta Ichthyologica et Piscatoria 44:201–211.

Al-Rasady, I., A. Govender, and S. M. Al-Jufaili. 2013. Age and growth of Longnose Trevally (*Carangoides Chrysophrys*) in the Arabian Sea. Journal of Applied Ichthyology 29:1056–1060.

Allman, R. J., W. F. Patterson, C. L. Fioramonti, and A. E. Pacicco. 2018. Factors affecting estimates of size at age and growth in Grey Triggerfish *Balistes Capriscus* from the northern Gulf of Mexico. Journal of Fish Biology 92:386–398.

Allman, Robert J., Gary R. Fitzhugh, K. J. Starzinger, and R. A. Farsky. 2005. Precision of age estimation in Red Snapper (*Lutjanus Campechanus*). Fisheries Research 73:123–133.

Anderson, J., A. Morison, and D. Ray. 1992a. Age and growth of Murray Cod, *Maccullochella Peelii* (Perciformes: Percichthyidae), in the Lower Murray-Darling Basin, Australia, from thin-sectioned otoliths. Marine and Freshwater Research 43:983–1013.

Anderson, J., A. Morison, and D. Ray. 1992b. Validation of the use of thin-sectioned otoliths for determining the age and growth of Golden Perch, *Macquaria Ambigua* (Perciformes: Percichthyidae), in the Lower Murray-Darling Basin, Australia. Marine and Freshwater Research 43:1103–1128.

Andrade, H. A. 2004. Age and growth of the Searobin (*Prionotus Punctatus*) in Brazilian waters. Bulletin of Marine Science 75:1–9.

Andrews, A. H., G. M. Cailliet, and K. H. Coale. 1999. Age and growth of the Pacific Grenadier (*Coryphaenoides Acrolepis*) with age estimate validation using an improved radiometric ageing technique. Canadian Journal of Fisheries and Aquatic Sciences 56:1339–1350.

Anislado-Tolentino, V., M. G. Cabello, F. A. Linares, and C. R. Mendoza. 2008. Age and growth of the Scalloped Hammerhead Shark, *Sphyrna Lewini* (Griffith & Smith, 1834) from the Southern coast of Sinaloa, México. Hidrobiológica 18:31–40.

Artero, C., D. Murie, C. Koenig, R. Berzins, C. Bouchon, and L. Lampert. 2015. Age, growth, and mortality of the Atlantic Goliath Grouper *Epinephelus Itajara* in French Guiana. Endangered Species Research 28:275–287.

Aschenbrenner, A., and B. P. Ferreira. 2015. Age, growth and mortality of *Lutjanus Alexandrei* in estuarine and coastal waters of the tropical south-western Atlantic. Journal of Applied Ichthyology 31:57–64.

Aschenbrenner, A., M. O. Freitas, G. R. A. Rocha, R. L. de Moura, R. B. Francini-Filho, C. Minte-Vera, and B. P. Ferreira. 2017. Age, growth parameters and fisheries indices for the Lane Snapper in the Abrolhos Bank, SW Atlantic. Fisheries Research 194:155–163.

Ba, A., K. Diouf, F. Guilhaumon, and J. Panfili. 2015. Slow growth of the overexploited Milk Shark *Rhizoprionodon Acutus* Affects Its Sustainability in West Africa. Journal of Fish Biology 87:912–929.

Balazik, M. T., S. P. McIninch, G. C. Garman, and R. J. Latour. 2012. Age and growth of Atlantic Sturgeon in the James River, Virginia, 1997-2011. Transactions of the American Fisheries Society 141:1074–1080.

Barada, T. J., A. J. Blank, and M. A. Pegg. 2011. Bias, precision, and processing time of otoliths and pectoral

spines used for age estimation of Channel Catfish. American Fisheries Society Symposium 77:723–731.

Barbieri, L. R., M. E. C. Jr, and C. M. Jones. 1994. Age, growth, and mortality of Atlantic Croaker, *Micropogonias Undulatus*, in the Chesapeake Bay region, with a discussion of apparent geographic changes in population dynamics. Fishery Bulletin 91:1–12.

Barreto, R. R., R. P. Lessa, F. H. Hazin, and F. M. Santana. 2011. Age and growth of the Blacknose Shark, *Carcharhinus Acronotus* (Poey, 1860) off the northeastern Brazilian Coast. Fisheries Research 110:170–176.

Başusta, A., N. Başusta, M. Calta, and E. I. Ozcan. 2017. A study on age and growth characteristics of Spiny Gurnard (*Lepidotrigla Dieuzeidei* Blanc & Hureau, 1973), northeastern Mediterranean Sea. Journal of Applied Ichthyology 33:966–970.

Bauerlien, C. J., M. R. Cornett, E. A. Zielonka, D. P. Crane, and J. S. Bulak. 2018. Precision of calcified structures used for estimating age of Chain Pickerel *Esox Niger*. North American Journal of Fisheries Management 38.

Beckman, D. W. 2002. Comparison of aging methods and validation of otolith ages for the Rainbow Darter, *Etheostoma Caeruleum*. Copeia 2002:830–835.

Beckman, D. W., A. L. Stanley, J. H. Render, and C. A. Wilson. 1990. Age and growth of Black Drum in Louisiana waters of the Gulf of Mexico. Transactions of the American Fisheries Society 119:537–544.

Beckman, D. W., C. A. Wilson, and A. L. Stanley. 1988. Age and growth of Red Drum, *Sciaenops Ocellatus*, from offshore waters of the northern Gulf of Mexico. Fisheries Bulletin, U.S. 87:17–28.

Bellodi, A., C. Porcu, R. Cannas, A. Cau, M. F. Marongiu, A. Mulas, S. Vittori, and M. C. Follesa. 2017. Life-history traits of the Long-nosed Skate *Dipturus Oxyrinchus*. Journal of Fish Biology 90:867–888.

Besler, D. A. 1999. Utility of Scales and Whole Otoliths for Aging Largemouth Bass in North Carolina - PDF. Proceedings of the Annual Conference of the Southeastern Fish and Wildlife Agencies 53:119–129.

Bettinger, J. M., and J. S. Crane. 2011. Validation of annulus formation in otoliths of Notchlip Redhorse (*Moxostoma Collapsum*) and Brassy Jumprock (*Moxostoma* sp.) in Broad River, South Carolina, with observations on their growth and mortality. Southeastern Naturalist 10:443–458.

Bishop, S. D. H., M. P. Francis, C. Duffy, and J. C. Montgomery. 2006. Age, growth, maturity, longevity and natural mortality of the Shortfin Mako Shark (*Isurus Oxyrinchus*) in New Zealand waters. Marine and Freshwater Research 57:143–154.

Blackwell, B. G., T. M. Kaufman, and T. S. Moos. 2016. An assessment of calcified structures for estimating Northern Pike ages. North American Journal of Fisheries Management 36:964–974.

Bokhutlo, T., O. L. F. Weyl, K. Mosepele, and G. G. Wilson. 2015. Age and growth of Sharptooth Catfish, *Clarias Gariepinus* (Burchell, 1822) (Clariidae), in the Lower Okavango Delta, Botswana. Marine and Freshwater Research 66:420–428.

Bostanci, D. 2008. A comparison of calcified structures for aging of Pikeperch ( *Sander Lucioperca* ) in Bafra Fish Lake, Turkey. Journal of Freshwater Ecology 23:485–486.

Bostanci, D., G. Kurucu, and N. Polat. 2015. Evaluating bony structures for ageing and growth parameters of *Capoeta Banarescui* inhabiting the lower Melet River (Ordu, Turkey). Journal of Applied Ichthyology 31:704–708.

Bostanci, D., N. Polat, and S. Yilmaz. 2009. Age determination and annulus formation of Crucian Carp ( *Carassius Gibelio* ) inhabiting Egirdir Lake and Bafra Fish Lake, Turkey. Journal of Freshwater Ecology 24:331–333.

Boughamou, N. 2014. Otolithometry and scalimetry – two valid methods to describe the growth of Peacock Wrasse, *Symphodus Tinca* (Actinopterygii: Perciformes: Labridae) from eastern Algeria. Acta Ichthyologica

- et Piscatoria 44:285-293.
- Boxrucker, J. 1986. A comparison of the otolith and scale methods for aging White Crappies in Oklahoma. North American Journal of Fisheries Management 6:122–125.
- Braaten, P. J., S. E. Campana, D. B. Fuller, R. D. Lott, R. M. Bruch, and G. R. Jordan. 2015. Age estimations of wild Pallid Sturgeon (*Scaphirhynchus Albus*, Forbes & Richardson 1905) based on pectoral fin spines, otoliths and bomb radiocarbon: Inferences on recruitment in the dam-fragmented Missouri River. Journal of Applied Ichthyology 31:821–829.
- Braaten, P. J., M. R. Doeringsfeld, and C. S. Guy. 1999. Comparison of age and growth estimates for River Carpsuckers using scales and dorsal fin ray sections. North American Journal of Fisheries Management 19:786–792.
- Braccini, J. M., B. M. Gillanders, T. I. Walker, and J. Tovar-Avila. 2007. Comparison of deterministic growth models fitted to length-at-age data of the Piked Spurdog (*Squalus Megalops*) in south-eastern Australia. Marine and Freshwater Research 58:24–33.
- Breeggemann, J. J., C.-A. Hayer, J. Krause, L. D. Schultz, K. N. Bertrand, and B. D. S. Graeb. 2014. Estimating the ages of Mountain Sucker *Catostomus Platyrhynchus* from the Black Hills: Precision, maturation, and growth. Western North American Naturalist 74:299–310.
- Brenden, T. O., E. M. Hallerman, and B. R. Murphy. 2006. Sectioned pelvic fin ray ageing of Muskellunge *Esox Masquinongy* from a Virginia river: Comparisons among readers, with cleithrum estimates, and with tag-recapture growth data. Fisheries Management and Ecology 13:31–37.
- Brennan, J. S., and G. M. Cailliet. 1989. Comparative age-determination techniques for White Sturgeon in California. Transactions of the American Fisheries Society 118:296–310.
- Brouder, M. J. 2005. Age and growth of Roundtail Chub in the Upper Verde River, Arizona. Transactions of the American Fisheries Society 134:866–871.
- Brown, P., C. Green, K. P. Sivakumaran, D. Stoessel, and A. Giles. 2004. Validating otolith annuli for annual age determination of Common Carp. Transactions of the American Fisheries Society 133:190–196.
- Brusher, J., and J. Schull. 2009. Non-lethal age determination for juvenile Goliath Grouper *Epinephelus Itajara* from southwest Florida. Endangered Species Research 7:205–212.
- Bubley, W. J., J. Kneebone, J. A. Sulikowski, and P. C. W. Tsang. 2012. Reassessment of Spiny Dogfish Squalus Acanthias age and growth using vertebrae and dorsal-fin spines. Journal of Fish Biology 80:1300–1319.
- Buckmeier, D. L., E. R. Irwin, R. K. Betsill, and J. A. Prentice. 2002. Validity of otoliths and pectoral spines for estimating ages of Channel Catfish. North American Journal of Fisheries Management 22:934–942.
- Buckmeier, D. L., N. G. Smith, and K. S. Reeves. 2012. Utility of Alligator Gar age estimates from otoliths, pectoral fin rays, and scales. Transactions of the American Fisheries Society 141:1510–1519.
- Bwanika, G. N., D. J. Murie, and L. J. Chapman. 2007. Comparative age and growth of Nile Tilapia (*Oreochromis Niloticus* L.) in lakes Nabugabo and Wamala, Uganda. Hydrobiologia 589:287–301.
- Calis, E., E. H. Jackson, C. P. Nolan, and F. Jeal. 2005. Preliminary age and growth estimates of the Rabbitfish, *Chimaera Monstrosa*, with implications for future resource management. Journal of Northwest Atlantic Fishery Science 35:15–26.
- Carlson, J. K., and I. E. Baremore. 2005. Growth dynamics of the Spinner Shark (*Carcharhinus Brevipinna*) off the United States southeast and Gulf of Mexico coasts: A comparison of methods. Fishery Bulletin 103:280–291.
- Carlson, J. K., and G. R. Parsons. 1997. Age and growth of the Bonnethead Shark, *Sphyrna Tiburo*, from northwest Florida, with comments on clinal variation. Environmental Biology of Fishes 50:331–341.
- Cazorla, A. L., and N. Sidorkewicj. 2011. Age, growth and reproduction in Creole Perch (Percichthys Trucha)

in the Negro River, Argentinean Patagonia. Journal of Applied Ichthyology 27:30–38.

Cerdenares-Ladrón De Guevara, G., E. Morales-Bojórquez, and R. Rodríguez-Sánchez. 2011. Age and growth of the Sailfish *Istiophorus Platypterus* (Istiophoridae) in the Gulf of Tehuantepec, Mexico. Marine Biology Research 7:488–499.

Charvet, P., F. M. Santana, K. L. D. Lima, and R. Lessa. 2018. Age and growth of the endemic Xingu River Stingray *Potamotrygon Leopoldi* validated using fluorescent dyes. Journal of Fish Biology 92:1985–1999.

Chater, I., A. Romdhani, J. L. Dufour, K. Mahe, P. Francour, and N. Chakroun-Marzouk. 2015. Otolith growth and age estimation of Bastard Grunt, *Pomadasys Incisus* (Actinopterygii: Perciformes: Haemulidae), in the Gulf of Tunis (Central Mediterranean). Acta Ichthyologica et Piscatoria 45:57–63.

Chen, K.-S., T. Shimose, T. Tanabe, C.-Y. Chen, and C.-C. Hsu. 2012. Age and growth of Albacore *Thunnus Alalunga* in the North Pacific Ocean. Journal of Fish Biology 80:2328–2344.

Choat, J., and L. Axe. 1996. Growth and longevity in acanthurid fishes; An analysis of otolith increments. Marine Ecology Progress Series 134:15–26.

Cicia, A. M., W. B. Driggers, G. W. Ingram, J. Kneebone, P. C. W. Tsang, D. M. Koester, and J. A. Sulikowski. 2009. Size and age estimates at sexual maturity for the Little Skate *Leucoraja Erinacea* from the western Gulf of Maine, U.S.A. Journal of Fish Biology 75:1648–1666.

Coelho, R., and K. Erzini. 2008. Life history of a wide-ranging Deepwater Lantern Shark in the north-east Atlantic, *Etmopterus Spinax* (Chondrichthyes: Etmopteridae), with implications for conservation. Journal of Fish Biology 73:1419–1443.

Colombo, R. E., Q. E. Phelps, C. M. Miller, J. E. Garvey, R. C. Heidinger, and N. S. Richards. 2010. Comparison of Channel Catfish age estimates and resulting population demographics using two common structures. North American Journal of Fisheries Management 30:305–308.

Conrath, C. L., J. Gelsleichter, and J. A. Musick. 2002. Age and growth of the Smooth Dogfish (*Mustelus Canis*) in the northwest Atlantic Ocean. Fishery Bulletin 100:674–682.

Copeland, T., M. W. Hyatt, and J. Johnson. 2007. Comparison of methods used to age Spring-Summer Chinook Salmon in Idaho: Validation and simulated effects on estimated age composition. North American Journal of Fisheries Management 27:1393–1401.

Coulson, P. G., N. G. Hall, and I. C. Potter. 2016. Biological characteristics of three co-occurring species of rmorhead from different genera vary markedly from previous resuAlts for the Pentacerotidae. Journal of Fish Biology 89:1393–1418.

Cuevas-Zimbrón, E., O. Sosa-Nishizaki, J. C. Pérez-Jiménez, and J. B. O'Sullivan. 2013. An analysis of the feasibility of using caudal vertebrae for ageing the Spinetail Devilray, *Mobula Japanica* (Müller and Henle, 1841). Environmental Biology of Fishes 96:907–914.

Currey, L. M., A. J. Williams, B. D. Mapstone, C. R. Davies, G. Carlos, D. J. Welch, C. A. Simpfendorfer, A. C. Ballagh, A. L. Penny, E. M. Grandcourt, A. Mapleston, A. S. Wiebkin, and K. Bean. 2013. Comparative biology of tropical *Lethrinus* species (Lethrinidae): Challenges for multi-species management. Journal of Fish Biology 82:764–788.

Davis, C. D., G. M. Cailliet, and D. A. Ebert. 2007. Age and growth of the Roughtail Skate *Bathyraja Trachura* (Gilbert 1892) from the eastern North Pacific. Environmental Biology of Fishes 80:325.

Dawson, H. A., M. L. Jones, K. T. Scribner, and S. A. Gilmore. 2009. An assessment of age determination methods for Great Lakes larval Sea Lampreys. North American Journal of Fisheries Management 29:914–927.

de Santana, H. S., and C. V. Minte-Vera. 2017. Age and growth of *Prochilodus Lineatus* in a spatially structured population: Is there concordance between otoliths and scales? Environmental Biology of Fishes 100:223–235.

Debicella, J. M. 2005. Accuracy and precision of fin-ray ageing for Gag (Mycteroperca Microlepis). Masters

- of Science, Florida.
- Delgado, J., S. Reis, J. A. González, E. Isidro, M. Biscoito, M. Freitas, and V. M. Tuset. 2013. Reproduction and growth of *Aphanopus Carbo* and *A. Intermedius* (Teleostei: Trichiuridae) in the northeastern Atlantic. Journal of Applied Ichthyology 29:1008–1014.
- DeMartini, E. E., J. H. Uchiyama, R. L. Humphreys Jr., J. D. Sampaga, and H. A. Williams. 2007. Age and growth of Swordfish (*Xiphias Gladius*) caught by the Hawaii-based pelagic longline fishery. Fishery Bulletin 105:356–367.
- Dembkowski, D. J., D. A. Isermann, and R. P. Koenigs. 2017. Walleye age estimation using otoliths and dorsal spines: Preparation techniques and sampling guidelines based on sex and total length. Journal of Fish and Wildlife Management 8:474–486.
- Doño, F., S. Montealegre-Quijano, A. Domingo, and P. G. Kinas. 2015. Bayesian age and growth analysis of the Shortfin Mako Shark *Isurus Oxyrinchus* in the Western South Atlantic Ocean Using a Flexible Model. Environmental Biology of Fishes 98:517–533.
- Driggers, W., J. Carlson, B. Cullum, J. Dean, and D. Oakley. 2004. Age and growth of the Blacknose Shark, *Carcharhinus Acronotus*, in the western North Atlantic Ocean with comments on regional variation in growth rates. Environmental Biology of Fishes 71:171–178.
- Duan, Y.-J., C.-X. Xie, X.-J. Zhou, B.-S. Ma, and B. Huo. 2014. Age and growth characteristics of *Schizopygopsis Younghusbandi* Regan, 1905 in the Yarlung Tsangpo River in Tibet, China. Journal of Applied Ichthyology 30:948–954.
- Dulčić, J., A. Pallaoro, S. Matić-Skoko, B. Dragičević, P. Tutman, R. Grgičević, N. Stagličić, V. Bukvić, J. Pavličević, B. Glamuzina, and M. Kraljević. 2011. Age, growth and mortality of common Two-Banded Seabream, *Diplodus Vulgaris* (Geoffroy Saint-Hilaire, 1817), in the eastern Adriatic Sea (Croatian coast). Journal of Applied Ichthyology 27:1254–1258.
- Dutka-Gianelli, J., and D. J. Murie. 2001. Age and growth of Sheepshead, *Archosargus Probatocephalus* (Pisces: Sparidae), from the northwest coast of Florida. Bulletin of Marine Science 68:69–83.
- Dzul, M. C., D. B. Gaines, J. R. Fischer, M. C. Quist, and S. J. Dinsmore. 2012. Evaluation of otoliths of Salt Creek Pupfish (*Cyprinodon Salinus*) for use in analyses of age and growth. The Southwestern Naturalist 57:412–416.
- Efitre, J., D. J. Murie, and L. J. Chapman. 2016. Age validation, growth and mortality of introduced *Tilapia Zillii* in Crater Lake Nkuruba, Uganda. Fisheries Management and Ecology 23:66–75.
- Eklund, J., R. Parmanne, and G. Aneer. 2000. Between-reader variation in Herring otolith ages and effects on estimated population parameters. Fisheries Research 46:147–154.
- Ellender, B. R., O. L. F. Weyl, and H. Winker. 2012. Age and growth and maturity of southern Africa's largest cyprinid fish, the Largemouth Yellowfish *Labeobarbus Kimberleyensis*. Journal of Fish Biology 81:1271–1284.
- Elzey, S. P., K. A. Rogers, and K. J. Trull. 2014. Comparison of 4 aging structures in the American Shad (*Alosa Sapidissima*). Fishery Bulletin 113:47–54.
- Erhardt, J. M., and D. L. Scarnecchia. 2013. Precision and accuracy of age and growth estimates based on fin rays, scales, and mark-recapture information for migratory Bull Trout. Northwest Science 87:307–316.
- Erickson, C. M. 1983. Age determination of Manitoban Walleyes using otoliths, dorsal spines, and scales. North American Journal of Fisheries Management 3:176–181.
- Esteves, E., P. Simões, H. M. Silva, and J. P. Andrade. 1995. Ageing of Swordfish, *Xiphias Gladius* Linnaeus, 1758, from the Azores, using sagittae, anal-fin spines and vertebrae. ARQUIPÉLAGO. Ciências Biológicas e Marinhas- Life and Marine Sciences 13:39–51.
- Ewing, G. P., J. M. Lyle, R. J. Murphy, J. M. Kalish, and P. E. Ziegler. 2007. Validation of age and growth in a long-lived temperate reef fish using otolith structure, oxytetracycline and bomb radiocarbon methods.

- Marine and Freshwater Research 58:944-955.
- Ewing, G. P., D. C. Welsford, A. R. Jordan, and C. Buxton. 2003. Validation of age and growth estimates using thin otolith sections from the Purple Wrasse, *Notolabrus Fucicola*. Marine and Freshwater Research 54:985–993.
- Farley, J. H., A. J. Williams, N. P. Clear, C. R. Davies, and S. J. Nicol. 2013. Age estimation and validation for South Pacific Albacore *Thunnus Alalunga*. Journal of Fish Biology 82:1523–1544.
- Farrell, E. D., S. Mariani, and M. W. Clarke. 2010. Age and growth estimates for the Starry Smoothhound (*Mustelus Asterias*) in the Northeast Atlantic Ocean. ICES Journal of Marine Science 67:931–939.
- Faust, M. D., J. J. Breeggemann, S. Bahr, and B. D. Graeb. 2013. Precision and bias of cleithra and sagittal otoliths used to estimate ages of Northern Pike. Journal of Fish and Wildlife Management 4:332–341.
- Faust, M. D., D. A. Isermann, M. A. Luehring, and M. J. Hansen. 2015. Muskellunge growth potential in northern Wisconsin: Implications for trophy management. North American Journal of Fisheries Management 35:765–774.
- Feitosa, C. V., M. E. Araújo, and B. P. Ferreira. 2017. Estimates on age, growth and mortality of the French Angelfish *Pomacanthus Paru* (Bloch, 1787) (Teleostei: Pomacanthidae) in the southwestern Atlantic. Journal of Applied Ichthyology 33:409–414.
- Fernando, A. V., C. R. Peacock, B. W. Baker, and M. A. Eggleton. 2014. Ageing precision and error analysis of whole-view and sectioned otoliths in Largemouth Bass and Spotted Bass. Journal of the Southeastern Association of Fish and Wildlife Agencies 1:75–82.
- Ferri, J., J. Brčić, F. Škeljo, L. Sršen, and A. Uvodić. 2017. A preliminary study on the age and growth of the Argentine, *Argentina Sphyraena* (Actinopterygii: Osmeriformes: Argentinidae) from the eastern Adriatic Sea. Acta Ichthyologica et Piscatoria 47:365–369.
- Flain, M., and G. J. Glova. 1988. A test of the reliability of otolith and scale readings of Chinook Salmon (*Oncorhynchus Tshawytscha*). New Zealand Journal of Marine and Freshwater Research 22:497–500.
- Fleming, W. L., and W. J. Stark. 2018. Precision of age estimates using three different aging methods for Walleye (*Sander Vitreus*) in Cedar Bluff Reservoir, Kansas. Transactions of the Kansas Academy of Science 121:427–434.
- Florin, A.-B., K. Hüssy, M. Blass, D. Oesterwind, R. Puntila, D. Ustups, C. Albrecht, Y. Heimbrand, E. Knospina, K. Koszarowski, and A. Odelström. 2018. How old are youEvaluation of age reading methods for the invasive Round Goby (*Neogobius Melanostomus*, Pallas 1814). Journal of Applied Ichthyology 34:653–658.
- Fossen, I., O. T. Albert, and E. M. Nilssen. 2003. Improving the precision of ageing assessments for Long Rough Dab by using digitised pictures and otolith measurements. Fisheries Research 60:53–64.
- Francis, M. P., and C. Ó. Maolagáin. 2000. Age, growth and maturity of a New Zealand endemic shark (*Mustelus Lenticulatus*) estimated from vertebral bands. Marine and Freshwater Research 51:35–42.
- Francis, M. P., C. Ó. Maolagáin, and D. Stevens. 2001. Age, growth, and sexual maturity of two New Zealand endemic skates, *Dipturus Nasutus* and *D. Innominatus*. New Zealand Journal of Marine and Freshwater Research 35:831–842.
- Frazier, B. S., W. B. Driggers, D. H. Adams, C. M. Jones, and J. K. Loefer. 2014. Validated age, growth and maturity of the Bonnethead *Sphyrna Tiburo* in the western North Atlantic Ocean. Journal of Fish Biology 85:688–712.
- French, B., I. C. Potter, S. A. Hesp, P. G. Coulson, and N. G. Hall. 2014. Biology of the Harlequin Fish *Othos Dentex* (Serranidae), with particular emphasis on sexual pattern and other reproductive characteristics. Journal of Fish Biology 84:106–132.
- Fujinami, Y., Y. Semba, S. Ohshimo, and S. Tanaka. 2018. Development of an alternative ageing technique

- for Blue Sark (Prionace Glauca) using the vertebra. Journal of Applied Ichthyology 34:590-600.
- Gallagher, C. P., K. L. Howland, and R. J. Wastle. 2016. A comparison of different structures and methods for estimating age of northern-form Dolly Varden *Salvelinus Malma Malma* from the Canadian Arctic. Polar Biology 39:1257–1265.
- Gallagher, M. J., and C. P. Nolan. 1999. A novel method for the estimation of age and growth in rajids using caudal thorns. Canadian Journal of Fisheries and Aquatic Sciences 56:1590–1599.
- Gallagher, M. J., M. J. Green, and C. P. Nolan. 2006. The potential use of caudal thorns as a non-invasive ageing structure in the Thorny Skate (*Amblyraja Radiata* Donovan, 1808). Environmental Biology of Fishes 77:265–272.
- García-Mederos, A. M., V. M. Tuset, J. I. Santana, and J. A. González. 2010. Reproduction, growth and feeding habits of Stout Beardfish *Polymixia Nobilis* (Polymixiidae) off the Canary Islands (NE Atlantic). Journal of Applied Ichthyology 26:872–880.
- Gburski, C. M., S. K. Gaichas, and D. K. Kimura. 2007. Age and growth of Big Skate (*Raja Binoculata*) and Longnose Skate (*R. Rhina*) in the Gulf of Alaska. Environmental Biology of Fishes 80:337–349.
- Geraghty, P. T., A. S. Jones, J. Stewart, and W. G. Macbeth. 2012. Micro-computed tomography: An alternative method for shark ageing. Journal of Fish Biology 80:1292–1299.
- Geraghty, P. T., W. G. Macbeth, A. V. Harry, J. E. Bell, M. N. Yerman, and J. E. Williamson. 2014. Age and growth parameters for three heavily exploited shark species off temperate eastern Australia. ICES Journal of Marine Science 71:559–573.
- Gillanders, B. M., D. J. Ferrell, and N. L. Andrew. 1999. Aging methods for Yellowtail Kingfish, *Seriola Lalandi*, and results from age- and size-based growth models. Fishery Bulletin 97:812–827.
- Girgin, H., and N. Başusta. 2016. Testing staining techniques to determine age and growth of *Dasyatis Pastinaca* (Linnaeus, 1758) captured in Iskenderun Bay, northeastern Mediterranean. Journal of Applied Ichthyology 32:595–601.
- Glass, W. R., L. D. Corkum, and N. E. Mandrak. 2011. Pectoral fin ray aging: An evaluation of a non-lethal method for aging gars and its application to a population of the threatened Spotted Gar. Environmental Biology of Fishes 90:235–242.
- Goldman, K. J., and J. A. Musick. 2006. Growth and maturity of Salmon Sharks (*Lamna Ditropis*) in the eastern and western North Pacific, and comments on back-calculation methods. Fishery Bulletin 104:278–292.
- Goldman, K. J., S. Branstetter, and J. A. Musick. 2006. A re-examination of the age and growth of Sand Tiger Sharks, *Carcharias Taurus*, in the western North Atlantic: The importance of ageing protocols and use of multiple back-calculation techniques. Environmental Biology of Fishes 77:241–252.
- Goosen, A. J. J., and M. J. Smale. 1997. A preliminary study of age and growth of the Smoothhound Shark *Mustelus Mustelus* (Triakidae). South African Journal of Marine Science 18:85–91.
- Grabowski, T. B., S. P. Young, J. J. Isely, and P. C. Ely. 2012. Age, growth, and reproductive biology of three catostomids from the Apalachicola River, Florida. Journal of Fish and Wildlife Management 3:223–237.
- Grant, M. I., J. J. Smart, W. T. White, A. Chin, L. Baje, and C. A. Simpfendorfer. 2018. Life history characteristics of the Silky Shark *Carcharhinus Falciformis* from the central west Pacific. Marine and Freshwater Research 69:562–573.
- Gray, C. A., M. C. Ives, W. G. Macbeth, and B. W. Kendall. 2010. Variation in growth, mortality, length and age compositions of harvested populations of the herbivorous fish *Girella Tricuspidata*. Journal of Fish Biology 76:880–899.
- Gregg, J. L., D. M. Anderl, and D. K. Kimura. 2006. Improving the precision of otolith-based age estimates for Greenland Halibut (*Reinhardtius Hippoglossoides*) with preparation methods adapted for fragile sagittae.

- Fishery Bulletin 104:643–648.
- Griffin, K. M., Z. S. Beard, J. M. Flinders, and M. C. Quist. 2017. Estimating ages of Utah Chubs by use of pectoral fin rays, otoliths, and scales. Western North American Naturalist 77:189–194.
- Gu, P.-h., J.-g. Xiang, Y.-f. Chen, Y.-l. Li, J. Tang, S.-g. Xie, and Y. Chen. 2013. A comparison of different age estimation methods for the Northern Snakehead. North American Journal of Fisheries Management 33:994–999.
- Gumus, A., D. Bostanci, S. Yilmaz, and N. Polat. 2007. Age determination of *Scardinius Erythrophthalmus* (Cyprinidae) inhabiting Bafra Fish Lakes (Samsun, Turkey) based on otolith readings and marginal increment analysis. Cybium 31:59–66.
- Gutteridge, A. N., C. Huveneers, L. J. Marshall, I. R. Tibbetts, and M. B. Bennett. 2013. Life-history traits of a small-bodied coastal shark. Marine and Freshwater Research 64:54–65.
- Haas, D. L., D. A. Ebert, and G. M. Cailliet. 2016. Comparative age and growth of the Aleutian Skate, *Bathyraja Aleutica*, from the eastern Bering Sea and Gulf of Alaska. Environmental Biology of Fishes 99:813–828.
- Haas, R. E., and C. W. Recksiek. 1995. Age verification of Winter Flounder in Narragansett Bay. Transactions of the American Fisheries Society 124:103–111.
- Haglund, J. M., and M. G. Mitro. 2017. Age validation of Brown Trout in driftless area streams in Wisconsin using otoliths. North American Journal of Fisheries Management 37:829–835.
- Hale, L. F., and I. E. Baremore. 2013. Age and growth of the Sandbar Shark (*Carcharhinus Plumbeus*) from the northern Gulf of Mexico and the western North Atlantic Ocean. Gulf of Mexico Science 31:28–39.
- Hammers, B. E., and L. E. Miranda. 1991. Comparison of methods for estimating age, growth, and related population characteristics of White Crappies. North American Journal of Fisheries Management 11:492–498.
- Harry, A. V., A. J. Tobin, and C. A. Simpfendorfer. 2013. Age, growth and reproductive biology of the Spot-tail Shark, *Carcharhinus Sorrah*, and the Australian Blacktip Shark, *C. Tilstoni*, from the Great Barrier Reef World Heritage Area, north-eastern Australia. Marine and Freshwater Research 64:277–293.
- Henderson, A. C., A. I. Arkhipkin, and J. N. Chtcherbich. 2004. Distribution, growth and reproduction of the White-Spotted Skate *Bathyraja Albomaculata* (Norman, 1937) around the Falkland Islands. Journal of Northwest Atlantic Fishery Science 35:79–87.
- Herbst, S. J., and J. E. Marsden. 2011. Comparison of precision and bias of scale, fin ray, and otolith age estimates for Lake Whitefish (*Coregonus Clupeaformis*) in Lake Champlain. Journal of Great Lakes Research 37:386–389.
- Hill, K. T., G. M. Cailliet, and R. L. Radtke. 1989. A comparative analysis of growth zones in four calcified structures of Pacific Blue Marlin, *Makaim Nigricans*. Fishery Bulletin. U.S. 87:829–843.
- Hining, K. J., J. L. West, M. A. Kulp, and A. D. Neubauer. 2000. Validation of scales and otoliths for estimating age of Rainbow Trout from southern Appalachian streams. North American Journal of Fisheries Management 20:978–985.
- Hobbs, J.-P. A., A. J. Frisch, S. Mutz, and B. M. Ford. 2014. Evaluating the effectiveness of teeth and dorsal fin spines for non-lethal age estimation of a tropical reef fish, Coral Trout *Plectropomus Leopardus*. Journal of Fish Biology 84:328–338.
- Holmes, B. J., V. M. Peddemors, A. N. Gutteridge, P. T. Geraghty, R. W. K. Chan, I. R. Tibbetts, and M. B. Bennett. 2015. Age and growth of the Tiger Shark *Galeocerdo Cuvier* off the east coast of Australia. Journal of Fish Biology 87:422–448.
- Horn, P. 2002. Age and growth of Patagonian Toothfish (*Dissostichus Eleginoides*) and Antarctic Toothfish (*D. Mawsoni*) in waters from the New Zealand subantarctic to the Ross Sea, Antarctica. Fisheries Research

56:275-287.

Horn, P. L. 1997. An ageing methodology, growth parameters and estimates of mortality for Hake (*Merluccius Australis*) from around the South Island, New Zealand. Marine and Freshwater Research 48:201–209.

Howland, K. L., M. Gendron, W. M. Tonn, and R. F. Tallman. 2004. Age determination of a long-lived coregonid from the Canadian North: Comparison of otoliths, fin rays and scales in Inconnu (*Stenodus Leucichthys*). Annales Zoologici Fennici 41:205–214.

Hoxmeier, R. J. H., D. D. Aday, and D. H. Wahl. 2001. Factors influencing precision of age estimation from scales and otoliths of Bluegills in Illinois reservoirs. North American Journal of Fisheries Management 21:374–380.

Hubert, W. A., G. T. Baxter, and M. Harrington. 1987. Comparison of age determinations based on scales, otoliths and fin rays for Cutthroat Trout from Yellowstone Lake. Northwest Science 61:32–36.

Hurley, K. L., R. J. Sheehan, and R. C. Heidinger. 2004. Accuracy and precision of age estimates for Pallid Sturgeon from pectoral fin rays. North American Journal of Fisheries Management 24:715–718.

Huveneers, C., J. Stead, M. B. Bennett, K. A. Lee, and R. G. Harcourt. 2013. Age and growth determination of three sympatric Wobbegong sharks: How reliable is growth band periodicity in Orectolobidae? Fisheries Research 147:413–425.

Hyndes, G. A. 1992. Influence of sectioning otoliths on marginal increment trends and age and growth estimates for the Flathead *Platycephalus Speculator*. Fishery Bulletin, U.S. 90:276–284.

Ihde, T. F., and M. E. Chittenden Jr. 2002. Comparison of calcified structures for aging Spotted Seatrout. Transactions of the American Fisheries Society 131:634–642.

Isermann, D. A., J. J. Breeggemann, and T. J. Paoli. 2018. Evaluation of anal fin spines, otoliths, and scales for estimating age and back-calculated lengths of Yellow Perch in southern Green Bay. Journal of Great Lakes Research.

Isermann, D. A., J. R. Meerbeek, G. D. Scholten, and D. W. Willis. 2003. Evaluation of three different structures used for Walleye age estimation with emphasis on removal and processing times. North American Journal of Fisheries Management 23:625–631.

Isermann, D. A., M. H. Wolter, and J. J. Breeggemann. 2010. Estimating Black Crappie age: An assessment of dorsal spines and scales as nonlethal alternatives to otoliths. North American Journal of Fisheries Management 30:1591–1598.

Ishikawa, T., and K. Tachihara. 2012. Reproductive biology, growth, and age composition of non-native Indian Glassy Fish *Parambassis Ranga* (Hamilton, 1822) in Haebaru Reservoir, Okinawa-jima Island, southern Japan. Journal of Applied Ichthyology 28:231–237.

Jackson, N. D., J. E. Garvey, and R. E. Colombo. 2007a. Comparing aging precision of calcified structures in Shovelnose Sturgeon. Journal of Applied Ichthyology 23:525–528.

Jackson, Z. J., M. C. Quist, J. G. Larscheid, E. C. Thelen, and M. J. Hawkins. 2007b. Precision of scales and dorsal spines for estimating age of Common Carp. Journal of Freshwater Ecology 22:231–239.

Jacobsen, I. P., and M. B. Bennett. 2010. Age and growth of *Neotrygon Picta*, *Neotrygon Annotata* and *Neotrygon Kuhlii* from North-East Australia, with Notes on Their Reproductive Biology. Journal of Fish Biology 77:2405–2422.

Jacobsen, I. P., and M. B. Bennett. 2011. Life history of the Blackspotted Whipray *Himantura Astra*. Journal of Fish Biology 78:1249–1268.

James, K. C., D. A. Ebert, L. J. Natanson, and G. M. Cailliet. 2014. Age and growth characteristics of the Starry Skate, *Raja Stellulata*, with a description of life history and habitat trends of the central California, U.S.A., skate assemblage. Environmental Biology of Fishes 97:435–448.

Johnson, A. G., L. A. Collins, J. Dahl, and M. S. Baker. 1995. Age, growth, and mortality of Lane Snapper

- from the Northern Gulf of Mexico. Proceedings of the Annual Conference of the Southeastern Fish and Wildlife Agencies 49:178–186.
- Kelly, C. J., P. L. Connolly, and J. J. Bracken. 1997. Age estimation, growth, maturity and distribution of the Roundnose Grenadier from the Rockall trough. Journal of Fish Biology 50:1–17.
- Kendall, B. W., and C. A. Gray. 2009. Reproduction, age and growth of *Sillago Maculata* in south-eastern Australia. Journal of Applied Ichthyology 25:529–536.
- Kendall, B. W., C. A. Gray, and D. Bucher. 2009. Age validation and variation in growth, mortality and population structure of *Liza Argentea* and *Myxus Elongatus* (Mugilidae) in two temperate Australian estuaries. Journal of Fish Biology 75:2788–2804.
- Khan, M. A., and S. Khan. 2009. Comparison of age estimates from scale, opercular bone, otolith, vertebrae and dorsal fin ray in *Labeo Rohita* (Hamilton), *Catla Catla* (Hamilton) and *Channa Marulius* (Hamilton). Fisheries Research 100:255–259.
- Khan, M. A., S. Khan, and S. Khan. 2017. Precision of age estimates in Striped Snakehead *Channa Striata* (Bloch, 1793) from the Ganga River and its tributaries (rivers Gomti and Yamuna). Journal of Applied Ichthyology 33:230–235.
- Khan, M. A., S. Khan, and K. Miyan. 2011a. Precision of aging structures for Indian Major Carp, *Cirrhinus Mrigala*, from the River Ganga. Journal of Freshwater Ecology 26:231–239.
- Khan, S., M. Afzal Khan, and K. Miyan. 2011b. Comparison of age estimates from otoliths, vertebrae, and pectoral spines in African Sharptooth Catfish, *Clarias Gariepinus* (Burchell). Estonian Journal of Ecology 60:183–193.
- Khan, S., M. A. Khan, and K. Miyan. 2013. Evaluation of ageing precision from different structures of three threatened freshwater fish species, *Clarias Batrachus*, *Heteropneustes Fossilis* and *Wallago Attu*. Folia Zoologica 62:103–109.
- Khan, S., M. A. Khan, K. Miyan, and F. A. Lone. 2015. Precision of age estimates from different ageing structures in selected freshwater teleosts. Journal of Environmental Biology:507–512.
- Killgore, K. J., J. J. Hoover, J. P. Kirk, S. G. George, B. R. Lewis, and C. E. Murphy. 2007. Age and growth of Pallid Sturgeon in the free-flowing Mississippi River. Journal of Applied Ichthyology 23:452–456.
- Kim, H. J., J. H. Na, and C.-W. Oh. 2016. Age and growth of Damselfish *Chromis Notata* (Temminck & Schlegel, 1843), Jeju Island, Korea. Journal of Applied Ichthyology 32:1179–1185.
- King, J., and R. McPhie. 2015. Preliminary age, growth and maturity estimates of Spotted Ratfish (*Hydrolagus Colliei*) in British Columbia. Deep Sea Research Part II: Topical Studies in Oceanography 115:55–63.
- King, S. M., S. R. David, and J. A. Stein. 2018. Relative bias and precision of age estimates among calcified structures of Spotted Gar, Shortnose Gar, and Longnose Gar. Transactions of the American Fisheries Society 147:626–638.
- Klein, Z. B., T. F. Bonvechio, B. R. Bowen, and M. C. Quist. 2017. Precision and accuracy of age estimates obtained from anal fin spines, dorsal fin spines, and sagittal otoliths for known-age Largemouth Bass. Southeastern Naturalist 16:225–234.
- Klein, Z. B., M. M. Terrazas, and M. C. Quist. 2014. Age estimation of Burbot using pectoral fin rays, branchiostegal rays and otoliths. Intermountain Journal of Sciences 20:57–67.
- Koch, J. D., M. C. Quist, and K. A. Hansen. 2009. Precision of hard structures used to estimate age of Bowfin in the upper Mississippi River. North American Journal of Fisheries Management 29:506–511.
- Koch, J. D., K. D. Steffensen, and M. A. Pegg. 2011. Validation of age estimates obtained from juvenile Pallid Sturgeon *Scaphirhynchus Albus* pectoral fin spines. Journal of Applied Ichthyology 27:209–212.
- Kocovsky, P. M., and R. F. Carline. 2000. A comparison of methods for estimating ages of unexploited

- Walleyes. North American Journal of Fisheries Management 20:1044–1048.
- Koenigs, R. P., R. M. Bruch, R. S. Stelzer, and K. K. Kamke. 2015. Validation of otolith ages for Walleye (Sander Vitreus) in the Winnebago system. Fisheries Research 167:13–21.
- Kotas, J. E., V. Mastrochirico, and M. Petrere Junior. 2011. Age and growth of the Scalloped Hammerhead Shark, *Sphyrna Lewini* (Griffith and Smith, 1834), from the southern Brazilian coast. Brazilian Journal of Biology 71:755–761.
- Kruse, C. G., W. A. Hubert, and F. J. Rahel. 1997. Using otoliths and scales to describe age and growth of Yellowstone Cutthroat Trout in a high-elevation stream system, Wyoming. Northwest Science 71:30–38.
- Kruse, C., C. Guy, and D. Willis. 1993. Comparison of otolith and scale age characteristics for Black Crappies collected from South Dakota waters. North American Journal of Fisheries Management 13:856–858.
- Kusher, D. I., S. E. Smith, and G. M. Cailliet. 1992. Validated age and growth of the Leopard Shark, *Triakis Semifasciata*, with comments on reproduction. Environmental Biology of Fishes 35:187–203.
- La Mesa, M., A. De Felice, C. D. Jones, and K.-H. Kock. 2009. Age and growth of Spiny Icefish (*Chaenodraco Wilsoni* Regan, 1914) off Joinville-Durville Islands (Antarctic Peninsula). CCAMLR Science 16:115–130.
- LaBay, S. R., and T. E. Lauer. 2006. An evaluation of the accuracy of age estimation methods for southern Lake Michigan Alewives. North American Journal of Fisheries Management 26:571–579.
- Labay, S. R., J. G. Kral, and S. M. Stukel. 2011. Precision of age estimates derived from scales and pectoral fin rays of Blue Sucker. Fisheries Management and Ecology 18:424–430.
- Laine, A. O., W. T. Momot, and P. A. Ryan. 1991. Accuracy of using scales and cleithra for aging Northern Pike from an oligotrophic Ontario lake. North American Journal of Fisheries Management 11:220–225.
- Law, C. S. W., and Y. S. de Mitcheson. 2018. Age and growth of Black Seabream *Acanthopagrus Schlegelii* (Sparidae) in Hong Kong and adjacent waters of the northern South China Sea. Journal of Fish Biology 93:382–390.
- Lepak, T. A., D. H. Ogle, and M. R. Vinson. 2017. Age, year-class strength variability, and partial age validation of Kiyis from Lake Superior. North American Journal of Fisheries Management 37:1151–1160.
- Lessa, R., and P. Duarte-Neto. 2004. Age and growth of Yellowfin Tuna (*Thunnus Albacares*) in the western equatorial Atlantic, using dorsal fin spines. Fisheries Research 69:157–170.
- Lessa, R., F. M. Santana, and F. H. Hazin. 2004. Age and growth of the blue shark *Prionace Glauca* (Linnaeus, 1758) off northeastern Brazil. Fisheries Research 66:19–30.
- Lessa, R., F. M. Santana, and R. Paglerani. 1999. Age, growth and stock structure of the Oceanic Whitetip Shark, *Carcharhinus Longimanus*, from the southwestern equatorial Atlantic. Fisheries Research 42:21–30.
- Li, X., Y. Chen, D. He, and F. Chen. 2008. Otolith characteristics and age determination of an endemic *Ptychobarbus Dipogon* (Regan, 1905) (Cyprinidae: Schizothoracinae) in the Yarlung Tsangpo River, Tibet. Environmental Biology of Fishes 86:53.
- Logsdon, D. E. 2007. Use of unsectioned dorsal spines for estimating Walleye ages. North American Journal of Fisheries Management 27:1112–1118.
- Lombardi-Carlson, L., G. Fitzhugh, C. Palmer, C. Gardner, R. Farsky, and M. Ortiz. 2008. Regional size, age and growth differences of Red Grouper (*Epinephelus Morio*) along the west coast of Florida. Fisheries Research 91:239–251.
- Long, J. M., and W. L. Fisher. 2001. Precision and bias of Largemouth, Smallmouth, and Spotted Bass ages estimated from scales, whole otoliths, and sectioned otoliths. North American Journal of Fisheries Management 21:636–645.
- Long, J. M., and A. A. Nealis. 2017. Comparative precision of age estimates from two southern reservoir

- populations of Paddlefish [Polyodon Spathula (Walbaum, 1792)]. Journal of Applied Ichthyology 33:819–820.
- Long, J. M., C. T. Holley, and A. T. Taylor. 2018. Evaluation of ageing accuracy with complementary non-lethal methods for slow-growing, northern populations of Shoal Bass. Fisheries Management and Ecology 25:150–157.
- Lorenzo, J. M., J. G. Pajuelo, M. Méndez-Villamil, J. Coca, and A. G. Ramos. 2002. Age, growth, reproduction and mortality of the Striped Seabream, *Lithognathus Mormyrus* (Pisces, Sparidae), off the Canary Islands (Central-east Atlantic). Journal of Applied Ichthyology 18:204–209.
- Lowerre-Barbieri, S. K., M. E. C. Jr, and C. M. Jones. 1993. A comparison of a validated otolith method to age Weakfish, *Cynoscion Regalis*, with the traditional scale method. Fishery Bulletin 92:555–568.
- Lozano, I. E., S. L. Vegh, A. A. Dománico, and A. E. Ros. 2014. Comparison of scale and otolith age readings for Trahira, *Hoplias Malabaricus* (Bloch, 1794), from Paraná River, Argentina. Journal of Applied Ichthyology 30:130–134.
- Luque, P. L., E. Rodriguez-Marin, J. Landa, M. Ruiz, P. Quelle, D. Macias, and J. M. O. D. Urbina. 2014. Direct ageing of *Thunnus Thynnus* from the eastern Atlantic Ocean and western Mediterranean Sea using dorsal fin spines. Journal of Fish Biology 84:1876–1903.
- Ma, B., Y. Nie, K. Wei, B. Xu, W. Gan, X. Zhu, J. Xu, L. Deng, and Y. Yao. 2017. Precision of age estimations from otolith, vertebra, and opercular bone of *Gymnocypris Firmispinatus* (Actinopterygii: Cypriniformes: Cyprinidae) in the Anning River, China. Acta Ichthyologica et Piscatoria 47:321–329.
- Ma, B., C. Xie, B. Huo, X. Yang, and P. Li. 2011. Age validation, and comparison of otolith, vertebra and opercular bone for estimating age of *Schizothorax o'connori* in the Yarlung Tsangpo River, Tibet. Environmental Biology of Fishes 90:159–169.
- Maceina, M. J., and S. M. Sammons. 2006. An evaluation of different structures to age freshwater fish from a northeastern US river. Fisheries Management and Ecology 13:237–242.
- MacNeil, M. A., and S. E. Campana. 2002. Comparison of whole and sectioned vertebrae for determining the age of young Blue Shark ( *Prionace Glauca* ). Journal of Northwest Atlantic Fishery Science 30:77–82.
- Malca, E., J. F. Barimo, J. E. Serafy, and P. J. Walsh. 2009. Age and growth of the Gulf Toadfish *Opsanus Beta* based on otolith increment analysis. Journal of Fish Biology 75:1750–1761.
- Marriott, R. J., and B. D. Mapstone. 2006. Geographic influences on and the accuracy and precision of age estimates for the Red Bass, *Lutjanus Bohar* (Forsskal 1775): A large tropical reef fish. Fisheries Research 80:322–328.
- Marriott, R., and M. Cappo. 2000. Comparative precision and bias of five different ageing methods for the Large Tropical Snapper *Lutjanus Johnii*. Asian Fisheries Science 13:149–160.
- Matić-Skoko, S., J. Ferri, F. Škeljo, V. Bartulović, K. Glavić, and B. Glamuzina. 2011. Age, growth and validation of otolith morphometrics as predictors of age in the Forkbeard, *Phycis Phycis* (Gadidae). Fisheries Research 112:52–58.
- Matić-Skoko, S., P. Tutman, J. Dulčić, I. Prusina, Ž. Đođo, J. Pavličević, and B. Glamuzina. 2011. Growth pattern of the endemic Neretvan Roach, *Rutilus Basak* (Heckel, 1843) in the Hutovo Blato wetlands. Journal of Applied Ichthyology 27:813–819.
- Matta, M. E., and D. R. Gunderson. 2007. Age, growth, maturity, and mortality of the Alaska Skate, *Bathyraja Parmifera*, in the eastern Bering Sea. Environmental Biology of Fishes 80:309–323.
- McAuley, R. B., C. A. Simpfendorfer, G. A. Hyndes, R. R. Allison, J. A. Chidlow, S. J. Newman, and R. C. J. Lenanton. 2006. Validated age and growth of the Sandbar Shark, *Carcharhinus Plumbeus* (Nardo 1827) in the waters off Western Australia. Environmental Biology of Fishes 77:385–400.
- McDougall, A. 2004. Assessing the use of sectioned otoliths and other methods to determine the age of the centropomid fish, Barramundi (*Lates Calcarifer*) (Bloch), using known-age fish. Fisheries Research

67:129-141.

McDowell, D. E., and E. Robillard. 2013. Life history characteristics and age validation of Southern Kingfish (*Menticirrhus Americanus* (Linnaeus, 1758)) in the middle South Atlantic Bight. Journal of Applied Ichthyology 29:839–846.

Meeuwig, M. H., and J. M. Bayer. 2005. Morphology and aging precision of statoliths from larvae of Columbia River basin Lampreys. North American Journal of Fisheries Management 25:38–48.

Meneghesso, C., E. Riginella, M. L. Mesa, F. Donato, and C. Mazzoldi. 2013. Life-history traits and population decline of the Atlantic Mackerel *Scomber Scombrusin* the Adriatic Sea. Journal of Fish Biology 83:1249–1267.

Metcalf, S. J., and S. E. Swearer. 2005. Non-destructive ageing in *Notolabrus Tetricus* using dorsal spines with an emphasis on the benefits for protected, endangered and fished species. Journal of Fish Biology 66:1740–1747.

Méndez Villamil, M., J. M. Lorenzo, J. G. Pajuelo, A. Ramos, and J. Coca. 2002. Aspects of the life history of the Salema, *Sarpa Salpa* (Pisces, Sparidae), off the Canarian Archipelago (Central-East Atlantic). Environmental Biology of Fishes 63:183–192.

Miller, M. E., J. Stewart, and R. J. West. 2010. Using otoliths to estimate age and growth of a large Australian endemic monocanthid, *Nelusetta Ayraudi* (Quoy and Gaimard, 1824). Environmental Biology of Fishes 88:263–271.

Morehouse, R. L., S. B. Donabauer, and A. C. Grier. 2013. Estimating Largemouth Bass age: Precision and comparisons among scales, pectoral fin rays, and dorsal fin spines as nonlethal methods. Fisheries and Aquaculture Journal 4:074.

Morison, A. K., J. Burnett, W. J. McCurdy, and E. Moksness. 2005. Quality issues in the use of otoliths for fish age estimation. Marine and Freshwater Research 56:773–782.

Morrow, J. V., J. P. Kirk, K. J. Killgore, and S. G. George. 1998. Age, growth, and mortality of Shovelnose Sturgeon in the Lower Mississippi River. North American Journal of Fisheries Management 18:725–730.

Moulton, P. L., T. I. Walker, and S. R. Saddlier. 1992. Age and growth studies of Gummy Shark, *Mustelus Antarcticus* Gunther, and School Shark, *Galeorhinus Galeus* (Linnaeus), from Souther Australian Waters. Marine and Freshwater Research 43:1241–1267.

Murie, D. J., and D. C. Parkyn. 2005. Age and growth of White Grunt (*Haemulon Plumieri*): A comparison of two populations along the west coast of Florida. Bulletin of Marine Science 76:73–93.

Murie, D. J., D. C. Parkyn, W. F. Loftus, and L. G. Nico. 2009a. Variable growth and longevity of Yellow Bullhead (*Ameiurus Natalis*) in the Everglades of south Florida, USA. Journal of Applied Ichthyology 25:740–745.

Murie, D. J., D. C. Parkyn, L. G. Nico, J. J. Herod, and W. F. Loftus. 2009b. Age, differential growth and mortality rates in unexploited populations of Florida Gar, an apex predator in the Florida Everglades. Fisheries Management and Ecology 16:315–322.

Murie, D., D. Parkyn, C. Koenig, F. Coleman, J. Schull, and S. Frias-Torres. 2009c. Evaluation of finrays as a non-lethal ageing method for protected Goliath Grouper *Epinephelus Itajara*. Endangered Species Research 7:213–220.

Natanson, L. J., and N. E. Kohler. 1996. A preliminary estimate of age and growth of the Dusky Shark *Carcharhinus Obscurus* from the South-West Indian Ocean, with comparisons to the western North Atlantic population. South African Journal of Marine Science 17:217–224.

Natanson, L. J., and G. B. Skomal. 2015. Age and growth of the White Shark, *Carcharodon Carcharias*, in the western North Atlantic Ocean. Marine and Freshwater Research 66:387.

Natanson, L. J., B. J. Gervelis, M. V. Winton, L. L. Hamady, S. J. B. Gulak, and J. K. Carlson. 2014.

- Validated age and growth estimates for *Carcharhinus Obscurus* in the northwestern Atlantic Ocean, with preand post management growth comparisons. Environmental Biology of Fishes 97:881–896.
- Natanson, L. J., J. Mello, and S. E. Campana. 2002. Validated age and growth of the Porbeagle Shark (*Lamna Nasus*) in the western North Atlantic Ocean. Fishery Bulletin 100:266–278.
- Natanson, L. J., J. A. Sulikowski, J. R. Kneebone, and P. C. Tsang. 2007. Age and growth estimates for the Smooth Skate, *Malacoraja Senta*, in the Gulf of Maine. Environmental Biology of Fishes 80:293–308.
- Neer, J. A., and B. A. Thompson. 2005. Life history of the Cownose Ray, *Rhinoptera Bonasus*, in the northern Gulf of Mexico, with comments on geographic variability in life history traits. Environmental Biology of Fishes 73:321–331.
- Neer, J. A., B. A. Thompson, and J. K. Carlson. 2005. Age and growth of *Carcharhinus Leucas* in the northern Gulf of Mexico: Incorporating variability in size at birth. Journal of Fish Biology 67:370–383.
- Neves, A., V. Sequeira, A. R. Vieira, R. B. Paiva, and L. S. Gordo. 2015. Age and growth of Small Red Scorpionfish, *Scorpaena Notata* (Actinopterygii: Scorpaeniformes: Scorpaenidae), a common discard species from the Portuguese fishery. Acta Ichthyologica et Piscatoria 45:13–20.
- Neves, A., A. R. Vieira, V. Sequeira, R. B. Paiva, and L. S. Gordo. 2017. Modelling the growth of a protogynous sparid species, *Spondyliosoma Cantharus* (Teleostei: Sparidae). Hydrobiologia 797:265–275.
- Newman, S. J. 2002. Age, growth, mortality and population characteristics of the Pearl Perch, *Glaucosoma Buergeri* Richardson 1845, from deeper continental shelf waters off the Pilbara coast of north-western Australia. Journal of Applied Ichthyology 18:95–101.
- Niewinski, B. C., and C. P. Ferreri. 1999. A comparison of three structures for estimating the age of Yellow Perch. North American Journal of Fisheries Management 19:872–877.
- Ochwada-Doyle, F. A., J. Stocks, L. Barnes, and C. A. Gray. 2014. Reproduction, growth and mortality of the exploited sillaginid, *Sillago Ciliata* Cuvier, 1829. Journal of Applied Ichthyology 30:870–880.
- Oele, D. L., Z. J. Lawson, and P. B. McIntyre. 2015. Precision and bias in aging Northern Pike: Comparisons among four calcified structures. North American Journal of Fisheries Management 35:1177–1184.
- Officer, R. A., A. S. Gason, T. I. Walker, and J. G. Clement. 1996. Sources of variation in counts of growth increments in vertebrae from Gummy Shark, *Mustelus Antarcticus*, and School Shark, *Galeorhinus Galeus*: Implications for age determination. Canadian Journal of Fisheries and Aquatic Sciences 53:1765–1777.
- Ohta, I., Y. Akita, M. Uehara, and A. Ebisawa. 2017. Age-based demography and reproductive biology of three *Epinephelus* groupers, *E. Polyphekadion*, *E. Tauvina*, and *E. Howlandi* (Serranidae), inhabiting coral reefs in Okinawa. Environmental Biology of Fishes 100:1451–1467.
- Ohta, I., and A. Ebisawa. 2016. Age-based demography and sexual pattern of the White-Streaked Grouper, *Epinephelus Onqus* in Okinawa. Environmental Biology of Fishes 99:741–751.
- Oplinger, R. W. 2015. Hard structure aging precision and length-at-age data from two Northern Leatherside Chub populations. Intermountain Journal of Sciences 21:1–9.
- Ozcan, E., and N. Basusta. 2018. Preliminary study on age, growth and reproduction of *Mustelus Mustelus* (Elasmobranchii: Carcharhiniformes: Triakidae) inhabiting the Gulf of Iskenderun, north-eastern Mediterranean Sea. Acta Ichthyologica et Piscatoria 48:27–36.
- Paiva, R. B., A. Neves, V. Sequeira, A. R. Vieira, M. J. Costa, and L. S. Gordo. 2018. Age, growth and reproduction of the protandrous hermaphrodite fish, *Sarpa Salpa*, from the Portuguese continental coast. Journal of the Marine Biological Association of the United Kingdom 98:269–281.
- Pajuelo, J. G., and J. M. Lorenzo. 2000. Biology of the Sand Smelt, *Atherina Presbyter* (Teleostei: Atherinidae), off the Canary Islands (central-east Atlantic). Environmental Biology of Fishes 59:91–97.
- Pajuelo, J. G., and J. M. Lorenzo. 2003. The growth of the common Two-Banded Seabream, *Diplodus Vulgaris* (Teleostei, Sparidae), in Canarian waters, estimated by reading otoliths and by back-calculation.

- Journal of Applied Ichthyology 19:79–83.
- Pajuelo, J. G., J. Socorro, J. A. González, J. M. Lorenzo, J. A. Pérez-Peñalvo, I. Martínez, and C. M. Hernández-Cruz. 2006. Life history of the Red-Banded Seabream *Pagrus Auriga* (Sparidae) from the coasts of the Canarian archipelago. Journal of Applied Ichthyology 22:430–436.
- Pajuelo, and Lorenzo. 2001. Biology of the Annular Seabream, *Diplodus Annularis* (Sparidae), in coastal waters of the Canary Islands. Journal of Applied Ichthyology 17:121–125.
- Parra, M. del P. B., F. G. Magaña, and F. M. Farías. 2008. Age and growth of the Blue Shark, *Prionace Glauca* Linnaeus, 1758, in the Northwest coast off Mexico. Revista de biología marina y oceanografía Revista de Biología Marina y Oceanografía (43):513–520.
- Parsons, K. T., J. Maisano, J. Gregg, C. F. Cotton, and R. J. Latour. 2018. Age and growth assessment of western North Atlantic Spiny Butterfly Ray *Gymnura Altavela* (L. 1758) using computed tomography of vertebral centra. Environmental Biology of Fishes 101:137–151.
- Peltonen, H. 2002. Age determination of Baltic Herring from whole otoliths and from neutral red stained otolith cross sections. ICES Journal of Marine Science 59:323–332.
- Perry, R. C., and J. M. Casselman. 2012. Comparisons of precision and bias with two age interpretation techniques for opercular bones of Longnose Sucker, a long-lived northern fish. North American Journal of Fisheries Management 32:790–795.
- Pierce, S. J., and M. B. Bennett. 2009. Validated annual band-pair periodicity and growth parameters of Blue-spotted Maskray *Neotrygon Kuhlii* from south-east Queensland, Australia. Journal of Fish Biology 75:2490–2508.
- Piercy, A. N., J. K. Carlson, J. A. Sulikowski, and G. H. Burgess. 2007. Age and growth of the Scalloped Hammerhead Shark, *Sphyrna Lewini*, in the north-west Atlantic Ocean and Gulf of Mexico. Marine and Freshwater Research 58:34.
- Polat, N., and A. Gümücs. 1996. Ageing of Whiting (*Merlangius Merlangus Euxinus*, Nord., 1840) based on broken and burnt otolith. Fisheries Research 28:231–236.
- Polat, N., D. Bostanci, and S. Yilmaz. 2005. Differences between whole otolith and broken-burnt otolith ages of Red Mullet (*Mullus Barbatus Ponticus* Essipov, 1927) sampled from the Black Sea (Samsun, Turkey). Turkish Journal of Veterinary and Animal Science 29:429–433.
- Polat, N., D. Bostanci, and S. Yilmaz. 2011. Comparable age determination in different bony structures of *Pleuronectes Flesus Luscus Pallas*, 1811 inhabiting the Black Sea. Turkish Journal of Zoology 25:441–446.
- Porta, M. J., R. A. Snow, and D. E. Shoup. 2018. Comparison of Saugeye age estimates and population characteristics using otoliths and dorsal spines. Journal of the Southeastern Association of Fish and Wildlife Agencies 5:23–29.
- Power, G. R., P. A. King, C. J. Kelly, D. McGrath, E. Mullins, and O. Gullaksen. 2006. Precision and bias in the age determination of Blue Whiting, *Micromesistius Poutassou* (Risso, 1810), within and between age-readers. Fisheries Research 80:312–321.
- Puchala, E. A., D. L. Parrish, and D. H. Ogle. 2018. Size and age of stonecats in Lake Champlain; estimating growth at the margin of their range to aid in population management. North American Journal of Fisheries Management 38.
- Quist, M. C., Z. J. Jackson, M. R. Bower, and W. A. Hubert. 2007. Precision of hard structures used to estimate age of riverine Catostomids and Cyprinids in the upper Colorado River basin. North American Journal of Fisheries Management 27:643–649.
- Raitaniemi, J., E. Bergstrand, L. Flöystad, R. Hokki, E. Kleiven, M. Rask, M. Reizenstein, R. Saksgård, and C. Ångström. 1998. The reliability of Whitefish (*Coregonus Lavaretus* (L.)) age determination differences

between methods and between readers. Ecology of Freshwater Fish 7:25–35.

Ramírez-Pérez, J. S., C. Quiñonez-Velázquez, L. A. Abitia-Cardenas, and F. N. Melo-Barrera. 2011. Age and growth of Sailfish *Istiophorus Platypterus* (Shaw in Shaw and Nodder, 1792) from Mazatlan, Sinaloa, Mexico. Environmental Biology of Fishes 92:187–196.

Ribot-Carballal, M., F. Galván-Magaña, and C. Quiñónez-Velázquez. 2005. Age and growth of the Shortfin Mako Shark, *Isurus Oxyrinchus*, from the western coast of Baja California Sur, Mexico. Fisheries Research 76:14–21.

Rice, J. S., V. F. Gallucci, and G. H. Kruse. 2009. 14. Evaluation of the precision of age estimates for Spiny Dogfish. Pages 161–168 *in* V. F. Gallucci, G. A. McFarlane, and G. G. Bargmann, editors. Biology and Management of Dogfish Sharks. American Fisheries Society.

Rien, T. A., and R. C. Beamesderfer. 1994. Accuracy and precision of White Sturgeon age estimates from pectoral fin rays. Transactions of the American Fisheries Society 123:255–265.

Robillard, S. R., and J. E. Marsden. 1996. Comparison of otolith and scale ages for Yellow Perch from Lake Michigan. Journal of Great Lakes Research 22:429–435.

Robinson, J. M., K. J. Jirka, and J. A. Chiotti. 2010. Age and growth analysis of the Central Mudminnow, *Umbra Limi* (Kirtland, 1840). Journal of Applied Ichthyology 26:89–94.

Romine, J. G., R. D. Grubbs, and J. A. Musick. 2006. Age and growth of the Sandbar Shark, *Carcharhinus Plumbeus*, in Hawaiian waters through vertebral analysis. Environmental Biology of Fishes 77:229–239.

Ross, J. R., J. D. Crosby, and J. T. Kosa. 2005. Accuracy and precision of age estimation of Crappies. North American Journal of Fisheries Management 25:423–428.

Rovani, A. T., and L. G. Cardoso. 2017. Life history and initial assessment of fishing impacts on the by-catch species *Dules Auriga* (Teleostei: Serranidae) in southern Brazil. Journal of Fish Biology 91:896–911.

Sabah, and M. A. Khan. 2014. Precise age estimation and growth of three Schizothoracinae fishes from Kashmir valley. Zoology and Ecology 24:16–25.

Santana, H. S. de, A. C. Rodrigues, and C. D. Tos. 2016. Patterns of reproduction and growth of the catfish *Iheringichthys Labrosus* (Lütken, 1874) after a reservoir formation. Journal of Applied Ichthyology 32:456–463.

Santana, F. M., and R. Lessa. 2004. Age determination and growth of the Night Shark (*Carcharhinus Signatus*) off the northeastern Brazilian coast. Fishery Bulletin 102:156–167.

Scarcella, G., M. La Mesa, F. Grati, and P. Polidori. 2011. Age and growth of the Small Red Scorpionfish, *Scorpaena Notata* Rafinesque, 1810, based on whole and sectioned otolith readings. Environmental Biology of Fishes 91:369.

Schill, D. J., E. R. J. M. Mamer, and G. W. LaBar. 2010. Validation of scales and otoliths for estimating age of Redband Trout in high desert streams of Idaho. Environmental Biology of Fishes 89:319–332.

Schwamborn, S. H. L., and B. P. Ferreira. 2002. Age structure and growth of the Dusky Damselfish, *Stegastes Fuscus*, from Tamandare reefs, Pernambuco, Brazil. Environmental Biology of Fishes 63:79–88.

Seibert, J. R., and Q. E. Phelps. 2013. Evaluation of aging structures for Silver Carp from Midwestern U.S. rivers. North American Journal of Fisheries Management 33:839–844.

Semba, Y., H. Nakano, and I. Aoki. 2009. Age and growth analysis of the Shortfin Mako, *Isurus Oxyrinchus*, in the western and central North Pacific Ocean. Environmental Biology of Fishes 84:377–391.

Serra-Pereira, B., I. Figueiredo, P. Bordalo-Machado, I. Farias, T. Moura, and L. S. Gordo. 2005. Age and growth of *Raja Clavata* Linnaeus, 1758 evaluation of ageing precision using different types of caudal denticles.

ICES CM 2005/N:17 - Elasmobranch Fisheries Science:1–10.

Sharp, D., and D. R. Bernard. 1988. Precision of estimated ages of Lake Trout from five calcified structures. North American Journal of Fisheries Management 8:367–372.

Shih, N.-T., K.-C. Hsu, and I.-H. Ni. 2011. Age, growth and reproduction of Cutlassfishes *Trichiurus* spp. in the southern East China Sea. Journal of Applied Ichthyology 27:1307–1315.

Shimose, T., and A. Nanami. 2014. Age, growth, and reproductive biology of Blacktail Snapper, *Lutjanus Fulvus*, around the Yaeyama Islands, Okinawa, Japan. Ichthyological Research 61:322–331.

Shimose, T., and A. Nanami. 2015. Age, growth, and reproduction of Blackspot Snapper *Lutjanus Fulviflammus* (Forsskål 1775) around Yaeyama Islands, southern Japan, between 2010 and 2014. Journal of Applied Ichthyology 31:1056–1063.

Silva, E. A., and D. J. Stewart. 2006. Age structure, growth and survival rates of the commercial fish *Prochilodus Nigricans* (bocachico) in North-eastern Ecuador. Environmental Biology of Fishes 77:63–77.

Simpfendorfer, C. A., J. Chidlow, R. McAuley, and P. Unsworth. 2000. Age and Growth of the Whiskery Shark, *Furgaleus Macki*, from Southwestern Australia. Environmental Biology of Fishes 58:335–343.

Simpfendorfer, C. A., R. B. McAuley, J. Chidlow, and P. Unsworth. 2002. Validated age and growth of the Dusky Shark, *Carcharhinus Obscurus*, from western Australian waters. Marine and Freshwater Research 53:567–573.

Sipe, A. M., and M. E. Chittenden Jr. 2001. A comparison of calcified structures for aging summer flounder, Paralichthys dentatus | Scientific Publications Office. Fisheries Bulletin 99:628–640.

Sipe, A. M., and M. E. Chittenden Jr. 2002. A comparison of calcified structures for aging Bluefish in the Chesapeake Bay region. Transactions of the American Fisheries Society 131:783–790.

Skomal, G. B., and L. J. Natanson. 2003. Age and growth of the Blue Shark, *Prionace Glauca*, in the north Atlantic Ocean. Fisheries Bulletin, U.S. 101:627–639.

Smith, B. J., D. J. Dembkowski, D. A. James, and M. R. Wuellner. 2016. A simple method to reduce interpretation error of ages estimated from otoliths. The Open Fish Science Journal 9:1–7.

Smylie, M., V. Shervette, and C. McDonough. 2016. Age, growth, and reproduction in two coastal populations of Longnose Gars. Transactions of the American Fisheries Society 145:120–135.

Snow, R. A., M. J. Porta, and J. M. Long. 2018. Precision of four otolith techniques for estimating age of White Perch from a thermally altered reservoir. North American Journal of Fisheries Management 38:725–733.

Soekoe, M., F. van der Bank, and N. Smit. 2013. Determining the most suitable method of otolith preparation for estimating the age of Tigerfish, *Hydrocynus Vittatus* in the Pongolapoort Dam, South Africa. African Zoology 48:187–192.

Soeth, M., L. F. Fávaro, H. L. Spach, F. A. Daros, A. E. Woltrich, and A. T. Correia. 2018. Age, growth, and reproductive biology of the Atlantic Spadefish *Chaetodipterus Faber* in southern Brazil. Ichthyological Research.

Sotola, V. A., G. A. Maynard, E. M. Hayes-Pontius, T. B. Mihuc, M. H. Malchoff, and J. E. Marsden. 2014. Precision and bias of using opercles as compared to otoliths, dorsal spines, and scales to estimate ages of Largemouth and Smallmouth Bass. Northeastern Naturalist 21:565–573.

Soupir, C. A., B. B. Blackwell, and M. L. Brown. 1997. Relative precision among calcified structures for White Bass age and growth assessment. Journal of Freshwater Ecology 12:531–538.

Spiegel, J. R., M. C. Quist, and J. E. Morris. 2010. Precision of scales and pectoral fin rays for estimating age of Highfin Carpsucker, Quillback Carpsucker, and River Carpsucker. Journal of Freshwater Ecology

25:271-278.

Stevenson, J. T., and D. H. Secor. 2000. Age determination and growth of Hudson River Atlantic Sturgeon, *Acipenser Oxyrinchus*. Fishery Bulletin 98:153–166.

Stewart, J., and J. M. Hughes. 2007. Age validation and growth of three commercially important hemiramphids in south-eastern Australia. Journal of Fish Biology 70:65–82.

Stewart, J., W. Sumpton, M. Lockett, and J. M. Hughes. 2013. Age-based demographics of the Pearl Perch Glaucosoma Scapulare (Ramsay, 1881). Journal of Applied Ichthyology 29:801–807.

Stewart, N. D., M. J. Dadswell, P. Leblanc, R. G. Bradford, C. Ceapa, and M. J. W. Stokesbury. 2015. Age and growth of Atlantic Sturgeon from the Saint John River, New Brunswick, Canada. North American Journal of Fisheries Management 35:364–371.

Stewart, T. R., D. H. Ogle, O. T. Gorman, and M. R. Vinson. 2016. Age, growth, and size of Lake Superior Pygmy Whitefish (*Prosopium Coulterii*). The American Midland Naturalist 175:24–36.

Stolarski, J. T., and K. J. Hartman. 2008. An evaluation of the precision of fin ray, otolith, and scale age determinations for Brook Trout. North American Journal of Fisheries Management 28:1790–1795.

Stolarski, J. T., and T. M. Sutton. 2013. Precision analysis of three aging structures for amphidromous Dolly Varden from Alaskan arctic rivers. North American Journal of Fisheries Management 33:732–740.

Stransky, C., S. Gudmundsdottir, T. Sigurdsson, S. Lemvig, K. Nedreaas, and F. Saboridorey. 2005. Age determination and growth of Atlantic redfish (*Sebastes Marinus* and *S. Mentella*): Bias and precision of age readers and otolith preparation methods. ICES Journal of Marine Science 62:655–670.

Sulikowski, J. A., S. B. Irvine, K. C. DeValerio, and J. K. Carlson. 2007. Age, growth and maturity of the Roundel Skate, *Raja Texana*, from the Gulf of Mexico, USA. Marine and Freshwater Research 58:41–53.

Sulikowski, J. A., J. Kneebone, S. Elzey, J. Jurek, P. D. Danley, W. H. Howell, and P. C. W. Tsang. 2005a. Age and growth estimates of the Thorny Skate (*Amblyraja Radiata*) in the western Gulf of Maine. Fisheries Bulletin, U.S. 103:161–168.

Sulikowski, J. A., M. D. Morin, S. H. Suk, and W. H. Howell. 2003. Age and growth estimates of the Winter Skate (*Leucoraja Ocellata*) in the western Gulf of Maine. Fisheries Bulletin 101:405–413.

Sulikowski, J. A., P. C. W. Tsang, and W. H. Howell. 2005b. Age and size at sexual maturity for the Winter Skate, *Leucoraja Ocellata*, in the western Gulf of Maine based on morphological, histological and steroid hormone analyses. Environmental Biology of Fishes 72:429–441.

Sun, C.-L., S.-P. Wang, and S.-Z. Yeh. 2002. Age and growth of the Swordfish (*Xiphias Gladius L.*) in the waters around Taiwan determined from anal-fin rays. Fishery Bulletin 100:822–835.

Sun, C.-L., S.-Z. Yeh, C.-S. Liu, N.-J. Su, and W.-C. Chiang. 2015. Age and growth of Black Marlin (*Istiompax Indica*) off eastern Taiwan. Fisheries Research 166:4–11.

Škeljo, F., J. Brčić, V. Vuletin, and J. Ferri. 2015. Age and growth of the Axillary Wrasse, *Symphodus Mediterraneus* (L.) from the eastern Adriatic Sea. Marine Biology Research 11:780–784.

Škeljo, F., J. Ferri, J. Brčić, M. Petrić, and I. Jardas. 2012. Age, growth and utility of otolith morphometrics as a predictor of age in the Wrasse *Coris Julis* (Labridae) from the eastern Adriatic Sea. Scientia Marina 76:587–595.

Tanaka, S., G. M. Cailliet, and Yudin. 1990. Differences in growth of the Blue Shark, *Prionace Glauca*: Technique or population? National Oceanic and Atmospheric Administration Technical Report NMFS (National Marine Fisheries Service) 90:177–187.

Terwilliger, M. R., T. Reece, and D. F. Markle. 2010. Historic and recent age structure and growth of endangered Lost River and Shortnose Suckers in Upper Klamath Lake, Oregon. Environmental Biology of

Fishes 89:239-252.

Thompson, K. R., and D. W. Beckman. 1995. Validation of age estimates from White Sucker otoliths. Transactions of the American Fisheries Society 124:637–639.

Thornton, J. L., V. N. Kc, L. D. Frankland, C. R. Jansen, J. Hirst, and R. E. Colombo. 2018. Monitoring demographics of a commercially exploited population of Shovelnose Sturgeon in the Wabash River, Illinois/Indiana, USA. Journal of Applied Ichthyology.

Tičina, V., and S. Matić-Skoko. 2012. Age, growth and mortality of Scaldfish (*Arnoglossus Laterna* Walbaum, 1792) from the Adriatic Sea. Journal of Applied Ichthyology 28:836–841.

Trested, D. G., and J. J. Isely. 2011. Age, growth, mortality, and abundance of Lake Sturgeon in the Grasse River, New York, USA. Journal of Applied Ichthyology 27:13–19.

Tribuzio, C. A., G. H. Kruse, and J. T. Fujioka. 2010. Age and growth of Spiny Dogfish (*Squalus Acanthias*) in the Gulf of Alaska: Analysis of alternative growth models. Fishery Bulletin 108:119–135.

Tribuzio, C. A., M. E. Matta, C. Gburski, C. Blood, W. Bubley, and G. H. Kruse. 2018. Are Pacific Spiny Dogfish lying about their age? A comparison of ageing structures for *Squalus Suckleyi*. Marine and Freshwater Research 69:37–47.

Tuset, V. M., J. A. González, I. E. Lozano, and M. M. Garcia-Diaz. 2004. Age and growth of the Blacktail Comber, *Serranus Atricauda* (Serranidae), off the Canary Islands (central-eastern Atlantic). Bulletin of Marine Science 74:53–68.

Tyszko, S. M., and J. J. Pritt. 2017. Comparing otoliths and scales as structures used to estimate ages of Largemouth Bass: Consequences of biased age estimates. North American Journal of Fisheries Management 37:1075–1082.

van der Meulen, D. E., R. J. West, and C. A. Gray. 2013. An assessment of otoliths, dorsal spines and scales to age the Long-Finned Gurnard, *Lepidotrigla Argus*, Ogilby, 1910 (Family: Triglidae). Journal of Applied Ichthyology 29:815–824.

Vandergoot, C. S., M. T. Bur, and K. A. Powell. 2008. Lake Erie Yellow Perch age estimation based on three structures: Precision, processing times, and management implications. North American Journal of Fisheries Management 28:563–571.

Vilizzi, L. 2018. Age determination in Common Carp *Cyprinus Carpio*: History, relative utility of ageing structures, precision and accuracy. Reviews in Fish Biology and Fisheries 28:461–484.

Vilizzi, L., K. Walker, T. Jain, D. McGlennon, and V. Tsymbal. 1998. Interpretability and precision of annulus counts for calcified structures in Carp, *Cyprinus Carpio* L. Fundamental and Applied Limnology 143:121–127.

Visconti, V., E. D. L. Trip, M. H. Griffiths, and K. D. Clements. 2018. Life-history traits of the Leatherjacket *Meuschenia Scaber*, a Long-Lived Monacanthid. Journal of Fish Biology 92:470–486.

Visnjic-Jeftic, Z., M. Lenhardt, I. Navodaru, A. Hegedis, Z. Gacic, and M. Nikcevic. 2009. Reproducibility of age determination by scale and vertebra in Pontic Shad (*Alosa Pontica* Eichwald, 1838), from the Danube. Archives of Biological Sciences 61:337–341.

Walsh, M. G., A. P. Maloy, and T. P. O'Brien. 2008. Comparison of Rainbow Smelt age estimates from fin rays and otoliths. North American Journal of Fisheries Management 28:42–49.

Wang, T., D. Huang, Y. Zhao, H. Wang, S. Hu, and J. Shen. 2013. Age, growth and mortality of invasive Sharpbelly, *Hemiculter Leucisculus* (Basilewski, 1855) in Erhai Lake, China. Journal of Applied Ichthyology 29:1279–1285.

Watkins, C. J., T. J. Ross, R. S. Hardy, and M. C. Quist. 2015. Precision of hard structures used to estimate age of Mountain Whitefish (*Prosopium Williamsoni*). Western North American Naturalist 75:1–7.

Watson, G., and M. J. Smale. 1999. Age and growth of the Shortnose Spiny Dogfish Squalus Megalops from

- the Agulhas Bank, South Africa. South African Journal of Marine Science 21:9–18.
- Weber, M. J., and M. L. Brown. 2011. Comparison of Common Carp (*Cyprinus Carpio*) age estimates derived from dorsal fin spines and pectoral fin rays. Journal of Freshwater Ecology 26:195–202.
- Welch, T. J., M. J. van den Avyle, R. K. Betsill, and E. M. Driebe. 1993. Precision and relative accuracy of Striped Bass age estimates from otoliths, scales, and anal fin rays and spines. North American Journal of Fisheries Management 13:616–620.
- Wells, R. D., S. Kohin, S. L. Teo, O. E. Snodgrass, and K. Uosaki. 2013. Age and growth of North Pacific Albacore (*Thunnus Alalunga*): Implications for stock assessment. Fisheries Research 147:55–62.
- Whiteman, K. W., V. H. Travnichek, M. L. Wildhaber, A. DeLonay, D. Papoulias, and D. Tillett. 2004. Age estimation for Shovelnose Sturgeon: A cautionary note based on annulus formation in pectoral fin rays. North American Journal of Fisheries Management 24:731–734.
- Williamson, C. W., and R. R. Dirnberger. 2010. A comparison of techniques using dorsal spines to estimate Sauger age. North American Journal of Fisheries Management 30:1016–1019.
- Wilson, C. A., and D. L. Nieland. 2001. Age and growth of Red Snapper, *Lutjanus Campechanus*, from the Northern Gulf of Mexico off Louisiana. Fishery Bulletin 99:653–664.
- Winker, H., O. L. F. Weyl, A. J. Booth, and B. R. Ellender. 2010. Validating and corroborating the deposition of two annual growth zones in asteriscus otoliths of Common Carp *Cyprinus Carpio* from South Africa's largest impoundment. Journal of Fish Biology 77:2210–2228.
- Wintner, S. P. 2000. Preliminary study of vertebral growth rings in the Whale Shark, *Rhincodon Typus*, from the east coast of South Africa. Environmental Biology of Fishes 59:441–451.
- Wintner, S. P., S. F. J. Dudley, N. Kistnasamy, and B. Everett. 2002. Age and growth estimates for the Zambezi Shark, *Carcharhinus Leucas*, from the east coast of South Africa. Marine and Freshwater Research 53:557–566.
- Yamaguchi, A., T. Taniuchi, and M. Shimizu. 1996. Age and Growth of the Starspotted Dogfish *Mustelus Manazo* from Tokyo Bay, Japan. Fisheries science 62:919–922.
- Yates, J. R., C. J. Watkins, and M. C. Quist. 2016. Evaluation of hard structures used to estimate age of Common Carp. Northwest Science 90:195–205.
- Yigin, C. C., and A. Ismen. 2016. Age and growth of Spiny Dogfish *Squalus Acanthias* (Squalidae: Chondrichthyes) in the North Aegean Sea. Pakistan Journal of Zoology 48:1185–1191.
- Zhang, Z.-M., C.-X. Xie, H.-P. Ding, C.-J. Liu, X.-F. Ma, and L.-G. Cai. 2016. Age and growth of Bream *Abramis Brama* (Linnaeus, 1758) in the downstream section of Irtysh River in China. Journal of Applied Ichthyology 32:105–109.
- Zhiming, Z., D. Huiping, and X. Congxin. 2018. Comparison of five calcified structures for estimating the age of Bream *Abramis Brama* (L.) from the Irtysh River in China. Turkish Journal of Fisheries and Aquatic Sciences 18:845–852.
- Zhu, X., R. J. Wastle, K. L. Howland, D. J. Leonard, S. Mann, T. J. Carmichael, and R. F. Tallman. 2015. A comparison of three anatomical structures for estimating age in a slow-growing subarctic population of Lake Whitefish. North American Journal of Fisheries Management 35:262–270.
- Zymonas, N. D., and T. E. McMahon. 2009. Comparison of pelvic fin rays, scales and otoliths for estimating age and growth of Bull Trout, *Salvelinus Confluentus*. Fisheries Management and Ecology 16:155–164.

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Maceina and Sammons (2006) Fossen et al. (2003) Murie et al. (2009c) Koenigs et al. (2015) Brenden et al. (2006) Marriott and Cappo (2000) Khan et al. (2013) Polat and Gümücs (1996) Polat et al. (2011) Kotas et al. (2011) Morison et al. (2005) Goldman et al. (2006) Vilizzi et al. (1998) Lepak et al. (2017) Erhardt and Scarnecchia (2013) Gallagher et al. (2016) Herbst and Marsden (2011) King et al. (2018) Raitaniemi et al. (1998) Robillard and Marsden (1996) Snow et al. (2018) Zymonas and McMahon (2009) Sabah and Khan (2014) Morehouse et al. (2013) Klein et al. (2017) Sotola et al. (2014) Howland et al. (2004) Faust et al. (2013) Quist et al. (2007) Porta et al. (2018) Debicella (2005) Stransky et al. (2005) Hoxmeier et al. (2001) Oplinger (2015) Watkins et al. (2015) Khan et al. (2011b) Khan et al. (2015) Smith et al. (2016) Ross et al. (2005) Long and Fisher (2001) Isermann et al. (2010) Hurley et al. (2004) Isermann et al. (2003) Oele et al. (2015) Silva and Stewart (2006) La Mesa et al. (2009) Breeggemann et al. (2014) Logsdon (2007) Buckmeier et al. (2002) Stewart et al. (2016) Rien and Beamesderfer (1994) Vandergoot et al. (2008) Power et al. (2006) Dutka-Gianelli and Murie (2001) Eklund et al. (2000) Sulikowski et al. (2007) Hill et al. (1989) Buckmeier et al. (2012) Stolarski and Hartman (2008) Peltonen (2002) Anderson et al. (1992a) Natanson et al. (2007) Jackson et al. (2007a) Gumus et al. (2007) Marriott and Mapstone (2006) McDougall (2004) Brennan and Cailliet (1989) Anderson et al. (1992b) Dawson et al. (2009) Khan and Khan (2009) Barbieri et al. (1994) Meeuwig and Bayer (2005) Niewinski and Ferreri (1999) Sulikowski et al. (2005a) Haas and Recksiek (1995) Rice et al. (2009) Horn (2002) Barada et al. (2011) Gburski et al. (2007) Andrews et al. (1999) Calis et al. (2005) Ewing et al. (2003) Gallagher et al. (2006) Walsh et al. (2008) Carlson and Baremore (2005) Kruse et al. (1997) Gregg et al. (2006) Natanson et al. (2002) Esteves et al. (1995) Tribuzio et al. (2010) Boxrucker (1986) Welch et al. (1993) Kruse et al. (1993) Brown et al. (2004) Allman, Robert J. et al. (2005) Flain and Glova (1988) Choat and Axe (1996) Soekoe et al. (2013) Ewing et al. (2007) Andrade (2004) Hammers and Miranda (1991) Glass et al. (2011) Braaten et al. (1999) Spiegel et al. (2010) Hubert et al. (1987) Whiteman et al. (2004) Metcalf and Swearer (2005) Weber and Brown (2011) DeMartini et al. (2007) Labay et al. (2011) Sun et al. (2002) Stolarski and Sutton (2013) Copeland et al. (2007) Khan et al. (2011a) Koch et al. (2009) Seibert and Phelps (2013) Sharp and Bernard (1988) Perry and Casselman (2012) Zhu et al. (2015) Tyszko and Pritt (2017) Haglund and Mitro (2017) Gu et al. (2013) LaBay and Lauer (2006) Blackwell et al. (2016) Stewart et al. (2015) Kocovsky and Carline (2000) Laine et al. (1991) Bublev et al. (2012) Lowerre-Barbieri et al. (1993) Sipe and Chittenden Jr (2002) Kusher et al. (1992) Wells et al. (2013) Brusher and Schull (2009) Koch et al. (2011) Hobbs et al. (2014) Cerdenares-Ladrón De Guevara et al. (2011) Bauerlien et al. (2018) Isermann et al. (2018) Hyndes (1992) Beckman et al. (1990) Wilson and Nieland (2001) Ma et al. (2017) Tribuzio et al. (2018) Ozcan and Basusta (2018) Chater et al. (2015) Neves et al. (2015) Ferri et al. (2017) Boughamou (2014) Adams and Kerstetter (2014) Williamson and Dirnberger (2010) Erickson (1983) Farley et al. (2013) Polat et al. (2005) Fernando et al. (2014) Soeth et al. (2018) Acre et al. (2017) Hining et al. (2000) Beckman (2002) Škeljo et al. (2012) Matić-Skoko et al. (2011) Gallagher and Nolan (1999) Francis et al. (2001) Henderson et al. (2004) Yigin and Ismen (2016) Francis and Maolagáin (2000) Officer et al. (1996) Škeljo et al. (2015) Gillanders et al. (1999) Ihde and Chittenden Jr (2002) Lessa and Duarte-Neto (2004) Killgore et al. (2007) Besler (1999) Yates et al. (2016) Jackson et al. (2007b) Schill et al. (2010) Murie et al. (2009b) Smylie et al. (2016) Bwanika et al. (2007) Murie and Parkyn (2005) Long et al. (2018) Balazik et al. (2012) Stevenson and Secor (2000) Aschenbrenner et al. (2017) Harry et al. (2013) Bokhutlo et al. (2015) Efitre et al. (2016) Artero et al. (2015) Murie et al. (2009a) Lombardi-Carlson et al. (2008) Beckman et al. (1988) Brouder (2005) Puchala et al. (2018) Fleming and Stark (2018) Dembkowski et al. (2017) Johnson et al. (1995) Morrow et al. (1998) Winker et al. (2010) Griffin et al. (2017) Goldman and Musick (2006) Braccini et al. (2007) McAuley et al. (2006) Moulton et al. (1992) Pierce and Bennett (2009) Hale and Baremore (2013) Simpfendorfer et al. (2002) Bishop et al. (2006) Wintner (2000) Watson and Smale (1999) Conrath et al. (2002) Goosen and Smale (1997) Farrell et al. (2010) Yamaguchi et al. (1996) Romine et al. (2006) Lessa et al. (1999) Natanson and Kohler (1996) Holmes et al. (2015) Simpfendorfer et al. (2000) Barreto et al. (2011) Sun et al. (2015) King and McPhie (2015) Huveneers et al. (2013) Geraghty et al. (2014) Natanson and Skomal (2015) Natanson et al. (2014) Piercy et al. (2007) Ribot-Carballal et al. (2005) Skomal and Natanson (2003) Driggers et al. (2004) Geraghty et al. (2012) Neer et al. (2005) Horn (1997) Robinson et al. (2010) Kendall and Gray (2009) Florin et al. (2018) Al-Rasady et al. (2013) Cazorla

and Sidorkewicj (2011) Kim et al. (2016) Stewart et al. (2013) van der Meulen et al. (2013) Braaten et al. (2015) Trested and Isely (2011) Lozano et al. (2014) Wang et al. (2013) Başusta et al. (2017) Long and Nealis (2017) Fujinami et al. (2018) McDowell and Robillard (2013) Girgin and Başusta (2016) Bostanci et al. (2015) Duan et al. (2014) Feitosa et al. (2017) Tičina and Matić-Skoko (2012) Aschenbrenner and Ferreira (2015) Newman (2002) Dulčić et al. (2011) Shimose and Nanami (2015) Shih et al. (2011) Zhang et al. (2016) Lorenzo et al. (2002) Ochwada-Doyle et al. (2014) Pajuelo and Lorenzo (2003) Matić-Skoko et al. (2011) Delgado et al. (2013) Ishikawa and Tachihara (2012) García-Mederos et al. (2010) Santana et al. (2016) Pajuelo et al. (2006) Thornton et al. (2018) Pajuelo and Lorenzo (2001) Faust et al. (2015) Carlson and Parsons (1997) Jacobsen and Bennett (2010) Lessa et al. (2004) MacNeil and Campana (2002) Santana and Lessa (2004) Semba et al. (2009) Anislado-Tolentino et al. (2008) Wintner et al. (2002) Vilizzi (2018) Parsons et al. (2018) Ma et al. (2011) Scarcella et al. (2011) Schwamborn and Ferreira (2002) de Santana and Minte-Vera (2017) Terwilliger et al. (2010) Miller et al. (2010) Ohta et al. (2017) Ohta and Ebisawa (2016) Pajuelo and Lorenzo (2000) Méndez Villamil et al. (2002) Cuevas-Zimbrón et al. (2013) Davis et al. (2007) Haas et al. (2016) James et al. (2014) Doño et al. (2015) Matta and Gunderson (2007) Neer and Thompson (2005) Sulikowski et al. (2005b) Ramírez-Pérez et al. (2011) Li et al. (2008) Stewart and Hughes (2007) Chen et al. (2012) Luque et al. (2014) Law and Mitcheson (2018) Malca et al. (2009) Kelly et al. (1997) Gray et al. (2010) Kendall et al. (2009) Cicia et al. (2009) Frazier et al. (2014) Allman et al. (2018) Ellender et al. (2012) Charvet et al. (2018) Visconti et al. (2018) Coulson et al. (2016) Royani and Cardoso (2017) Bellodi et al. (2017) Ba et al. (2015) Meneghesso et al. (2013) Coelho and Erzini (2008) Jacobsen and Bennett (2011) French et al. (2014) Currey et al. (2013) Elzey et al. (2014) Sipe and Chittenden Jr (2001) Zhiming et al. (2018) Soupir et al. (1997) Bostanci (2008) Bostanci et al. (2009) Khan et al. (2017) Colombo et al. (2010) Serra-Pereira et al. (2005) Grant et al. (2018) Klein et al. (2014) Dzul et al. (2012) Visnjic-Jeftic et al. (2009) Grabowski et al. (2012) Parra et al. (2008) Tanaka et al. (1990) Thompson and Beckman (1995) Bettinger and Crane (2011) Shimose and Nanami (2014) Gutteridge et al. (2013) Sulikowski et al. (2003) Tuset et al. (2004) Paiva et al. (2018) Neves et al. (2017)