

# **Voucher collection guidance for freshwater fishes in DFO's Ontario and Prairie, and Arctic regions**

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## **ABSTRACT**

Mandrak, N.E., Bouvier, L.D., Colm, J.E., Enders, E.C., Watkinson, D., Holm, E., and Drake, D.A.R. 2022. Voucher collection guidance for freshwater fishes in DFO's Ontario and Prairie, and Arctic regions. *Can. Manuscr. Rep. Fish. Aquat. Sci.* 3235: iv + 30 p.

Collecting voucher specimens is an important scientific activity needed to improve data integrity as it allows species identities to be repeatedly and independently verified. Physical vouchers of each species from every site sampled are preferred, as any morphological or meristic trait can be used for identification and re-evaluated over time if species classifications change. Depending on the nature of the survey, physical vouchers may not be necessary and digital vouchers may be acceptable. Guidance for collecting suitable physical and digital (where appropriate) vouchers of freshwater fishes found in Fisheries and Oceans Canada's Ontario and Prairie, and Arctic regions is provided. Advice is also presented on methods for preserving and photographing specimens, including characters needed to identify species from photographs, and for archiving vouchers. Examples of suitable digital vouchers are included, as well as illustrations of common issues when photographing freshwater fishes.

## **RÉSUMÉ**

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La collecte de spécimens de référence est une activité scientifique importante nécessaire pour améliorer l'intégrité des données, car elle permet de vérifier de façon répétée et indépendante l'identité des espèces. Il est préférable d'avoir des spécimens de référence physiques de chaque espèce pour chaque site échantillonné, car les caractères morphologiques ou méristiques peuvent être utilisés pour l'identification et réévalués au fil du temps si la classification des espèces change. Selon la nature de l'étude, les spécimens de référence physiques peuvent ne pas être nécessaires et les spécimens de référence numériques peuvent être acceptés. Des lignes directrices pour la collecte de spécimens de référence physiques et numériques appropriés (le cas échéant) de poissons d'eau douce dans les régions de l'Ontario et des Prairies et de l'Arctique de Pêches et Océans Canada sont fournies. Des conseils sont également présentés sur les méthodes pour conserver et photographier des spécimens, y compris les caractères nécessaires pour identifier les espèces à partir de photographies, et pour archiver les spécimens de référence. Des exemples de spécimens de référence numériques appropriés sont inclus, ainsi que des illustrations de problèmes courants rencontrés au moment de photographier des poissons d'eau douce.

## INTRODUCTION

The collection of zoological voucher specimens has been an important scientific activity since the mid 1700's (Lane 1996). Most often, specimens are kept during field surveys to confirm the identity of a species at a particular location, as some species cannot be reliably identified in the field and require additional analyses, equipment, or expert validation. Vouchers are often used to understand a species' distribution, document morphometric variation in a species across its range, and catalogue biodiversity. Many other research questions have benefitted from archived museum specimens for purposes beyond the original intent of collection. For example, stable isotope and microchemistry analyses from tissues, and changes in morphology of collected specimens, have allowed scientists to understand the impacts of pollutants, climate change, and other environmental stressors over time (Rocha et al. 2014). Additionally, there can be consequences to not keeping voucher specimens (Wheeler 2003). If a species is taxonomically re-classified [e.g., Northern (*Lepomis peltastes*) and Longear (*L. megalotis*) sunfishes], collection records pre-dating the classification change that are not supported with a voucher are difficult or impossible to accurately update; a lack of vouchered specimens makes historical records questionable; and, the diversity of species complexes (e.g., the genus *Coregonus*) can be overlooked without voucher specimens.

Voucher specimens improve the integrity of collected data as the records can be independently and repeatedly verified (Huber 1998, Wheeler 2003). The gold standard of record keeping would be to always keep a specimen from each site. However, there is a trade-off with processing time and storage capacity in the field and in archive facilities.

In Canada, there is minimal guidance on properly documenting freshwater fishes in field surveys (Mandrak and Bouvier 2014). Many researchers have built capacity for collecting specimens into their projects or have relationships with natural history institutions where specimens can be archived and curated. But depending on the nature of the survey and the practitioners conducting it, museum-quality specimens may not always be necessary or feasible. The purpose of this document is to provide guidance on taking suitable physical vouchers and/or digital vouchers of fishes that are of sufficient quality that the identity of a species can be verified. It is intended to be used by aquatic practitioners to improve data integrity and validity of records; it may also be useful for meeting permit requirements for scientific sampling. This document covers all freshwater fishes in Fisheries and Oceans Canada's (DFO) Ontario and Prairie, and Arctic regions, extending from Alberta to Ontario and Northwest Territories and Nunavut. It builds on existing guidance for vouchering Ontario fishes from Mandrak and Bouvier (2014). It was developed in parallel with the *Guidance on the collection of freshwater mussel (Bivalvia: Unionida) vouchers within Canada* (Morris et al. 2022).

## METHODS

### CONSIDERATIONS

It is beyond the scope of this report to cover ethical considerations, permit-related conditions, or other legislative requirements involved in the collection of voucher specimens. It is assumed that the user of this report has obtained necessary training and permits, and will follow all guidelines set out by the Canadian Council on Animal Care; federal, provincial, and territorial fisheries regulations; Workplace Hazardous Materials Information System; and, Transportation of Dangerous Goods. Additionally, species not found in Table 1 should be kept and reported to federal or provincial/territorial agencies responsible for aquatic invasive species (e.g., in Ontario,

invasive species can be reported to the Invading Species Awareness Program hotline 1-800-563-7711 or through the [EDDMapS<sup>1</sup> application<sup>2\)</sup>](#).

## FISH IDENTIFICATION

Accurate identification and recording of captured fish species is essential. At least one field crew member should be trained in fish identification [e.g., Royal Ontario Museum (ROM) Fish Identification Course]. Reference materials including field guides and dichotomous keys should be made available to sampling crews for use in the field. Preliminary identifications should be conducted and recorded in the field, and vouchers (which may include photographs) of every species caught at a site should be kept for confirming identifications (unless otherwise stated on permits or authorizations). Ideally, two or three specimens of each suspected species representing different size classes would be kept. Any meristics (e.g., counts of fin rays, lateral line scales) or other morphometric observations (e.g., lips with transverse grooves) that are made in the field should be noted next to the species. Vouchers are typically whole individuals preserved for further examination in a lab, but digital vouchers may be taken for some species (i.e., common or large species that can be distinguished from similar species by external features) or locations (i.e., in locations where no similar species co-occur). In some cases, a fin clip preserved in 95% ethanol is required for positive identification through genetic analysis [e.g., Eastern (*Rhinichthys atratulus*) vs. Western (*R. obtusus*) Blacknose daces].

## PRESERVED VOUCHERS

The following guidance is for preserving species that cannot be vouchered digitally (modified from Portt et al. 2008). All small (see Table 1) juvenile fishes and all lampreys should be preserved in 95 – 100% ethanol (not denatured) to allow for in-laboratory identification and verification, and subsequent genetic analysis, if required. Alternatively, a fin clip can be taken and preserved in 95 – 100% ethanol, and the whole specimen kept in formaldehyde<sup>3</sup>. All other fishes can be preserved in 10% formaldehyde (10% concentration of 37% formaldehyde solution available commercially as buffered formalin). Formaldehyde enforces structural integrity in tissues and is, thus, the preferred fixative for identification when genetic analyses are not warranted. An incision may need to be made to allow preservative into the body cavity or bulky tissue areas of larger fish. For fishes > 200 mm in length, a small incision about half the length of the abdominal cavity should be made on the lower right side of the body. For fishes > 1 kg in weight, deep incisions on either side of the vertebrae operating from the inside should be made (Hubbs et al. 2004). To reduce potential pain, fishes should be sacrificed in an anesthetic solution (e.g., tricaine methanesulfonate buffered with sodium bicarbonate, clove oil) following a pre-approved protocol for appropriate concentrations for the species/body size prior to preservation<sup>4</sup>. All vouchers from a single site can be placed in a single container (e.g., wide-mouth chemical-safe plastic bottle, Whirl-Pak sample bag) so long as fish are not packed tightly.

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<sup>1</sup> EDDMapS web portal

<sup>2</sup> To download EDDMapS smartphone application

<sup>3</sup> Formaldehyde (and Formalin) solution is toxic, allergenic, and possibly carcinogenic and users must be trained in its proper handling and wear suitable protective equipment (see Canada Centre for Occupational Health and Safety, 2017).

<sup>4</sup> Specific anesthetic methods will vary based on fish size and animal care requirements, but may involve immersion of the fish for 10 minutes in 4 L of water with 10 mL of clove oil stock solution (1:3 parts clove oil with 95% ethanol).



Preservative should cover the fishes completely and air pockets should be removed from the container. It is essential that an indelible label (i.e., on all-weather paper written in pencil or India ink) with the site data (field number, waterbody name, latitude, longitude, date, collectors) be added to the container. A WHMIS label indicating chemical and safety information on the preservative should also be adhered to the container. After specimens have been fixed (approximately two weeks in formalin), they should be soaked in water and then transferred to 70% ethanol for long-term preservation and storage (see Hubbs et al. 2004).

As an alternative to chemical fixation, large-bodied specimens can be sacrificed and frozen. If working remotely and it is not possible to transport preservatives into a site or whole preserved vouchers out of a site, taking a series of photographs (see below on digital vouchers) and a fin clip preserved in 95% ethanol may be sufficient.

## **DIGITAL VOUCHERS**

The following guidance is for taking digital vouchers (modified from Portt et al. 2008). Photography requires skill, time, equipment, and a certain amount of fish handling expertise. A camera capable of macro-photography must be available in the field and, in some cases, the fish may be anesthetized to keep it still. Sensitivity to handling varies from species to species and some individuals may experience injury or mortality due to increased handling time required to obtain photographs, or after it is released. Specialized aquaria (“fish viewers”) should be used in the field to facilitate photography, and are especially helpful for displaying fins when ray counts are required. The key identification characters differ from species to species; therefore, the photographic views required also differ. The photographer must know these key identification characters so that they can be photographed, and photographs must be of sufficient quality to allow someone else to positively identify the fish.

Table 1 provides guidance on whether a digital voucher is acceptable for a species and, if so, the features that need to be photographed. In some cases, the necessity of a preserved voucher over a digital voucher varies regionally and with species. Regardless of the type of photograph that is being taken, it is imperative that the camera be zoomed in to ensure that the distinguishing characteristic fills the entire frame of the viewer and that a reference to scale exists in the photograph (i.e., fish is on a measuring board or aquaria is equipped with a ruler). It may be advisable to turn off the auto-focus features of the camera, especially when focusing on specific features (e.g., lips). Photographs should be taken against a light-coloured background. There should be only one specimen visible per photograph. The image should be crisp with a minimum resolution of 300 dpi. The photograph numbers should be recorded next to the fish species. It is good practice to include a photograph of the field sheet with the relevant site data (field number, waterbody name, latitude, longitude, date, collectors) at the start of the series of digital vouchers for each site. A label with the relevant site data could also be placed in the frame of the photograph. Example figures of good and poor quality digital vouchers are provided (Figures 1 – 11).

## **ARCHIVAL OF VOUCHERS**

All vouchers should be verified by at least one taxonomic expert, and their name and the date of identification should be recorded. Quality preserved vouchers should be archived with a museum or university collection where feasible.

Digital vouchers should be saved and the photograph files labeled with the unique site number and photograph number at a minimum. They should be backed-up in a second location. Digital vouchers must be kept at least until they have been verified and all permitting submissions have been approved. Archiving digital vouchers on an external hard-drive is a low cost, space-saving

solution for long-term storage. Quality digital vouchers can often be submitted to museums (e.g., the ROM) where they are catalogued and available through museum databases.

### **BACK-CORRECTION OF MISIDENTIFIED SPECIMENS**

On occasion, specimens are misidentified in the field, and re-identified and verified in the laboratory from a physical or digital voucher as a different species. If all the specimens captured were vouchered, species identities can be easily updated for the entire catch. However, if many individuals were caught but only a single voucher kept, the identity of the other individuals cannot be known. In studies where only presence/absence of a species is needed, only the species for which a voucher was kept should remain in the record. If catch per unit effort or relative abundance are needed, the specimens for which there is no voucher should be up-listed in the record to genus or family (depending on the number of similar or closely related species).

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## TABLES

Table 1. Guidance on vouchering method to be used for confirmation of species identification for freshwater fishes in DFO's Ontario and Prairie, and Arctic regions (modified from Portt et al. 2008 and Mandrak and Bouvier 2014). Note that digital vouchers are typically not suitable for small or juvenile fishes and that vouchers for such individuals should be preserved; size specifications are provided where keeping a specimen is essential. The columns ON (Ontario), AB (Alberta), SK (Saskatchewan), MB (Manitoba), NWT (Northwest Territories), and NU (Nunavut) indicate the known distribution (x) of each species. Preserved specimens are always recommended; however, this table provides guidance to allow confirmation of identification for some species using photography. All fin views to be photographed are assumed to be with spread or flared fins. Invasive species that should be reported to responsible authorities are indicated.

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<b>Petromyzontidae (Lampreys)</b>										
<i>Ichthyomyzon cataneus</i>	Chestnut Lamprey	Yes			x	x	x			
<i>Ichthyomyzon fossor</i>	Northern Brook Lamprey	Yes			x	x				
<i>Ichthyomyzon unicuspis</i>	Silver Lamprey	Yes			x	x				
<i>Lethenteron alaskense</i>	Alaskan Brook Lamprey	Yes							x	
<i>Lethenteron appendix</i>	American Brook Lamprey	Yes			x					
<i>Lethenteron camtschaticum</i>	Arctic Lamprey	Yes							x	
<i>Petromyzon marinus</i>	Sea Lamprey	Yes			x					
<b>Acipenseridae (Sturgeons)</b>										
<i>Acipenser fulvescens</i>	Lake Sturgeon		< 40 mm	1 - Full side view.	x	x	x	x		
<b>Lepisosteidae (Gars)</b>										

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Lepisosteus oculatus</i>	Spotted Gar		< 100 mm	1 - Full side view showing fins, lateral scales, and side markings. 2 - Full dorsal view showing body profiles and markings. 3 - Close-up dorsal view of head. 4 - Dorsal view between head and origin of dorsal fin to count mid-dorsal scales. Dry the area with cloth to show scales. 5 - Ventral view of head with gill membrane pulled back showing scales on isthmus (note: scales may need to be dyed using Alizarin Blue or Kool-Aid).	x					
<i>Lepisosteus osseus</i>	Longnose Gar		< 100 mm	1 - Full side view showing fins, lateral scales, and side markings. 2 - Full dorsal view showing body profiles and markings. 3 - Close-up dorsal view of head. 4 - Dorsal view between head and origin of dorsal fin to count mid-dorsal scales. Dry the area with cloth to show scales.	x					
<b>Amiidae (Bowfins)</b>										
<i>Amia calva</i>	Bowfin		< 40 mm	1 - Full side view. 2 - Gular plate.	x					
<b>Hiodontidae (Mooneyes)</b>										
<i>Hiodon alosoides</i>	Goldeye		< 50 mm	1 - Full side view, all fins extended. 2 - Close-up of keel to show scales.	x	x	x	x	x	
<i>Hiodon tergisus</i>	Mooneye		< 50 mm	1 - Full side view, all fins extended. 2 - Close-up of keel to show scales.	x	x	x	x		
<b>Anguillidae (Freshwater Eels)</b>										
<i>Anguilla rostrata</i>	American Eel			1 - Full side view.	x					
<b>Clupeidae (Herrings)</b>										
<i>Alosa pseudoharengus</i>	Alewife		< 50 mm	1 - Full side view. 2 - Close-up side view of head.	x					
<i>Alosa sapidissima</i>	American Shad		< 50 mm	1 - Full side view. 2 - Close-up side view of head.	x					
<i>Dorosoma cepedianum</i>	Gizzard Shad		< 40 mm	1 - Full side view. 2 - Dorsal fin with extended last dorsal ray visible.	x					
<b>Cyprinidae (Carps)</b>										

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Carassius auratus</i>	Goldfish	Yes (fin clip or full specimen in ethanol)			x	x	x	x		
<i>Carassius gibelio</i>	Prussian Carp	Yes (fin clip or full specimen in ethanol)					x	x		
<i>Ctenopharyngodon idella</i>	Grass Carp	Yes (report)			x					
<i>Cyprinus carpio</i>	Common Carp		< 40 mm	1 - Full side view. 2 - Ventral view of head clearly showing presence of barbels.	x	x	x			
<b>Tincidae</b>										
<i>Tinca tinca</i>	Tench	Yes (report)			x					
<b>Leuciscidae (Minnows)</b>										
<i>Campostoma anomalum</i>	Central Stoneroller		< 50 mm	1 - Full side view. 2 - Close-up side view of head. 3 - Ventral view of mouth showing shape and cartilaginous ridge.	x					
<i>Chrosomus eos</i>	Northern Redbelly Dace		< 40 mm	1 - Full side view. 2 - Close-up side view of head.	x	x	x	x	x	
<i>Chrosomus neogaeus</i>	Finescale Dace		< 40 mm	1 - Full side view. 2 - Close-up side view of head.	x	x	x	x	x	
<i>Clinostomus elongatus</i>	Redside Dace		< 40 mm	1 - Full side view showing fins and side colouration and markings. 2 - Close-up side view of head.	x					
<i>Couesius plumbeus</i>	Lake Chub	Yes, if barbel not visible (e.g., < 100 mm)	< 100 mm	1 - Full side view, pectoral fins spread out. 2 - Close-up side view of head (showing terminal barbel). 3 - Close-up view of splayed dorsal fin.	x	x	x	x	x	x
<i>Cyprinella spiloptera</i>	Spotfin Shiner	Yes, from St. Lawrence River	< 40 mm	1 - Full side view, dorsal fin erect. 2 - Ventral view of head showing intergular stripe.	x	x				
<i>Erimystax x-punctata</i>	Gravel Chub	Yes			x					
<i>Exoglossum maxilllingua</i>	Cutlip Minnow		< 40 mm	1 - Full side view. 2 - Ventral view of head clearly showing trilobed lower lip.	x					

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Hybognathus argyritis</i>	Western Silvery Minnow	Yes						x		
<i>Hybognathus hankinsoni</i>	Brassy Minnow	Yes			x	x	x	x		
<i>Hybognathus placitus</i>	Plains Minnow	Yes					x			
<i>Hybognathus regius</i>	Eastern Silvery Minnow	Yes			x					
<i>Luxilus chrysocephalus</i>	Striped Shiner		< 50 mm	1 - Full side view. 2 - Close-up dorsal view of head to dorsal fin origin. 3 - Close-up view of chin.	x					
<i>Luxilus cornutus</i>	Common Shiner		< 50 mm	1 - Full side view. 2 - Close-up dorsal view of head to dorsal fin origin. 3 - Close-up view of chin.	x	x	x			
<i>Lythrurus umbratilis</i>	Redfin Shiner		< 40 mm	1 - Full side view, dorsal fins erect. 2 - Dorsal view showing black blotch at dorsal fin base.	x					
<i>Macrhybopsis storeriana</i>	Silver Chub	Yes			x	x				
<i>Margariscus nachtriebi</i>	Northern Pearl Dace	Yes, from Lake Erie/ Niagara River	< 40 mm	1 - Full side view. 2 - Close-up side view of head.	x	x	x	x	x	x
<i>Mylocheilus caurinus</i>	Peamouth		< 40 mm	1 - Full side view. 2 - Close-up of erect pectoral fin.				x		
<i>Nocomis biguttatus</i>	Hornyhead Chub		< 40 mm	1 - Full side view. 2 - Close-up side view of head.	x	x				
<i>Nocomis micropogon</i>	River Chub		< 40 mm	1 - Full side view. 2 - Close-up side view of head.	x					
<i>Notemigonus crysoleucas</i>	Golden Shiner	Scale sample	< 40 mm	1 - Full side view, all fins extended. 2 - Close-up of keel to show scales.	x	x	x			
<i>Notropis anogenus</i>	Pugnose Shiner	Yes			x					
<i>Notropis atherinoides</i>	Emerald Shiner		< 40 mm	1 - Full side view, dorsal and pelvic fins extended clearly showing location of base of pelvic fin.	x	x	x	x	x	
<i>Notropis bifrenatus</i>	Bridle Shiner	Yes			x					
<i>Notropis blennioides</i>	River Shiner	Yes			x	x	x	x		
<i>Notropis buchanaui</i>	Ghost Shiner	Yes			x					

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Notropis dorsalis</i>	Bigmouth Shiner	Yes			x	x				
<i>Notropis heterodon</i>	Blackchin Shiner	Yes			x	x				
<i>Notropis heterolepis</i>	Blacknose Shiner	Yes			x	x	x			
<i>Notropis hudsonius</i>	Spottail Shiner		< 40 mm	1 - Full side view.	x	x	x	x	x	
<i>Notropis percobromus</i>	Carmine Shiner	Yes (fin clip or full specimen in ethanol)				x				
<i>Notropis photogenis</i>	Silver Shiner	Yes			x					
<i>Notropis rubellus</i>	Rosyface Shiner	Yes, from outside of lower Great Lakes	< 50 mm	1 - Full side view, dorsal and pelvic fins extended clearly showing location of base of pelvic fin.	x					
<i>Notropis stramineus</i>	Sand Shiner	Yes			x	x	x			
<i>Notropis texanus</i>	Weed Shiner	Yes				x				
<i>Notropis volucellus</i>	Mimic Shiner	Yes			x	x				
<i>Opsopoeodus emiliae</i>	Pugnose Minnow	Yes			x					
<i>Pimephales notatus</i>	Bluntnose Minnow		< 40 mm	1 - Full side view, dorsal fin erect. 2 - Dorsal view anterior to dorsal fin showing crowded scales. 3 - Close-up side view of head.	x	x				
<i>Pimephales promelas</i>	Fathead Minnow		< 40 mm	1 - Full side view, dorsal fin erect. 2 - Dorsal view anterior to dorsal fin showing crowded scales. 3 - Close-up side view of head.	x	x	x	x	x	
<i>Platygobio gracilis</i>	Fathead Chub		< 50 mm	1 - Full side view. 2 - Dorsal view with pectoral fins extended.		x	x	x	x	
<i>Ptychocheilus oregonensis</i>	Northern Pikeminnow		< 50 mm	1 - Full side view.				x		
<i>Rhinichthys cataractae</i>	Longnose Dace		< 40 mm	1 - Full side view. 2 - Close-up side view of head. 3 - Ventral view of mouth, with mouth closed showing size of snout overhang. 4 - Downward frontal view of mouth showing frenum.	x	x	x	x	x	

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Rhinichthys obtusus</i>	Western Blacknose Dace	Yes, from Lake Ontario/ St. Lawrence drainage (fin clip or full specimen in ethanol)		1 - Full side view. 2 - Close-up side view of head. 3 - Ventral view of mouth, with mouth closed showing size of snout overhang 4 - Downward frontal view of mouth showing frenum.	x	x	x			
<i>Richardsonius balteatus</i>	Redside Shiner	Yes						x		
<i>Scardinius erythrophthalmus</i>	Rudd	Yes		1 - Full side view, all fins extended. 2 - Close-up of keel to show scales.	x					
<i>Semotilus atromaculatus</i>	Creek Chub		< 40 mm	1 - Full side view, dorsal fin erect.	x	x	x			
<i>Semotilus corporalis</i>	Fallfish		< 40 mm	1 - Full side view, dorsal fin erect.	x					
<b>Catostomidae (Suckers)</b>										
<i>Carpodes cyprinus</i>	Quillback		< 50 mm	1 - Full side view, dorsal fin erect.	x	x	x	x		
<i>Catostomus catostomus</i>	Longnose Sucker		< 50 mm	1 - Full side view. 2 - Ventral view of head with finger holding mouth closed.	x	x	x	x	x	x
<i>Catostomus commersonii</i>	White Sucker		< 50 mm	1 - Full side view. 2 - Ventral view of head with finger holding mouth closed.	x	x	x	x	x	x
<i>Catostomus macrocheilus</i>	Largescale Sucker		< 50 mm	1 - Full side view. 2 - Ventral view of head with finger holding mouth closed. 3 - Close-up of pelvic fins showing membranous connection between pelvic fins and body.				x		
<i>Erimyzon sucetta</i>	Lake Chubsucker		< 20 mm	1 - Side view that shows each scale for a lateral scale count as well as fins and side pigmentation. 2 - Close-up side view of head. 3 - Ventral view of closed mouth showing lips.	x					
<i>Hypentelium nigricans</i>	Northern Hog Sucker		< 40 mm	1 - Full side view. 2 - Ventral view of head with finger holding mouth closed.	x					



Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Ictiobus bubalus</i>	Smallmouth Buffalo	Fin clip in ethanol in Great Lakes	< 200 mm	1 - Full side view showing fins and lateral line scales. 2 - Close-up of dorsal fin and side view of head. 3 - Close-up of mouth showing absence of barbels. 4 - Side and ventral view of closed mouth showing lips.	x					
<i>Ictiobus cyprinellus</i>	Bigmouth Buffalo	Fin clip in ethanol in Great Lakes	< 50 mm	1 - Full side view showing fins and lateral line scales. 2 - Close-up of dorsal fin and side view of head. 3 - Close-up of mouth showing absence of barbels. 4 - Side and ventral view of closed mouth showing lips.	x	x	x			
<i>Ictiobus niger</i>	Black Buffalo	Fin clip in ethanol in Great Lakes	< 200 mm	1 - Full side view showing fins and lateral line scales. 2 - Close-up of dorsal fin and side view of head. 3 - Close-up of mouth showing absence of barbels. 4 - Side and ventral view of closed mouth showing lips.	x					
<i>Minytrema melanops</i>	Spotted Sucker		< 50 mm	1 - Full side view that shows each scale for a lateral line scale count as well as fins and side pigmentation. 2 - Close-up side view of head. 3 - Side and ventral view of closed mouth showing lips.	x					
<i>Moxostoma anisurum</i>	Silver Redhorse		< 90 mm	1 - All sides of the caudal peduncle. 2 - Dorsal and caudal fins spread out to see shape and colour. 3 - Side view that shows each scale for a lateral line scale count. 4 - Ventral view of closed mouth showing lips to see the traverse lines on the plicae.	x	x	x	x		
<i>Moxostoma carinatum</i>	River Redhorse		< 90 mm	1 - All sides of the caudal peduncle. 2 - Dorsal and caudal fins spread out to see shape and colour. 3 - Side view that shows each scale for a lateral line scale count. 4 - Ventral view of closed mouth showing lips to see the traverse lines on the plicae.	x					
<i>Moxostoma duquesnei</i>	Black Redhorse		< 90 mm	1 - All sides of the caudal peduncle. 2 - Dorsal and caudal fins spread out to see shape and colour. 3 - Side view that shows each scale for a lateral line scale count. 4 - Ventral view of closed mouth showing lips to see the traverse lines on the plicae.	x					

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Moxostoma erythrurum</i>	Golden Redhorse		< 90 mm	1 - All sides of the caudal peduncle. 2 - Dorsal and caudal fins spread out to see shape and colour. 3 - Side view that shows each scale for a lateral line scale count. 4 - Ventral view of closed mouth showing lips to see the traverse lines on the plicae.	x	x				
<i>Moxostoma macrolepidotum</i>	Shorthead Redhorse		< 80 mm	1 - All sides of the caudal peduncle. 2 - Dorsal and caudal fins spread out to see shape and colour. 3 - Side view that shows each scale for a lateral line scale count. 4 - Ventral view of closed mouth showing lips to see the traverse lines on the plicae.	x	x	x	x		
<i>Moxostoma valenciennesi</i>	Greater Redhorse		< 90 mm	1 - All sides of the caudal peduncle. 2 - Dorsal and caudal fins spread out to see shape and colour. 3 - Side view that shows each scale for a lateral line scale count. 4 - Ventral view of closed mouth showing lips to see the traverse lines on the plicae.	x					
<i>Pantosteus jordani</i>	Plains Sucker	Yes (fin clip or full specimen in ethanol)					x	x		
<b>Ictaluridae (North American Catfishes)</b>										
<i>Ameiurus melas</i>	Black Bullhead		< 50 mm	1 - Full side view with anal and caudal fins splayed. 2 - Ventral view of head clearly showing barbels from base. 3 - Close-up of pectoral fin showing serrations on spine (best viewed with light transmitted through fin).	x	x	x			
<i>Ameiurus natalis</i>	Yellow Bullhead		< 50 mm	1 - Full side view with anal and caudal fins splayed. 2 - Ventral view of head clearly showing barbels from base.	x					
<i>Ameiurus nebulosus</i>	Brown Bullhead		< 50 mm	1 - Full side view with anal and caudal fins splayed. 2 - Ventral view of head clearly showing barbels from base. 3 - Close-up of pectoral fin showing serrations on spine (best viewed with light transmitted through fin).	x	x	x			

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Ictalurus punctatus</i>	Channel Catfish		< 40 mm	1 - Full side view. 2 - Caudal fin spread.	x	x	x			
<i>Noturus flavus</i>	Stonecat		< 40 mm	1 - Full side view, all fins extended. 2 - Full ventral view.	x	x	x	x		
<i>Noturus gyrinus</i>	Tadpole Madtom		< 40 mm	1 - Full side view, all fins extended.	x	x	x			
<i>Noturus insignis</i>	Margined Madtom	Yes			x					
<i>Noturus miurus</i>	Brindled Madtom	Yes			x					
<i>Noturus stigmosus</i>	Northern Madtom	Yes			x					
<i>Pylodictis olivaris</i>	Flathead Catfish		< 60 mm	1 - Full side view. 2 - Dorsal view of head.	x					
<b>Esocidae (Pikes)</b>										
<i>Esox americanus vermiculatus</i>	Grass Pickerel		< 50 mm	1 - Full side view. 2 - Close-up side view of head showing suborbital bar and cheek scalation. 3 - Ventral view of bottom jaw showing sub-mandibular pores.	x					
<i>Esox lucius</i>	Northern Pike		< 50 mm	1 - Full side view. 2 - Close-up side view of head showing suborbital bar and cheek scalation. 3 - Ventral view of bottom jaw showing sub-mandibular pores.	x	x	x	x	x	x
<i>Esox masquinongy</i>	Muskellunge		< 50 mm	1 - Full side view. 2 - Close-up side view of head showing suborbital bar and cheek scalation. 3 - Ventral view of bottom jaw showing sub-mandibular pores.	x	x				
<i>Esox niger</i>	Chain Pickerel	Yes			x					
<b>Umbridae (Mudminnows)</b>										
<i>Umbra limi</i>	Central Mudminnow		< 20 mm	1 - Full side view.	x	x	x			
<b>Osmeridae (Smelts)</b>										
<i>Hypomesus olidus</i>	Pond Smelt	Yes							x	
<i>Osmerus dentex</i>	Pacific Rainbow Smelt	Fin clips needed from Nunavut		1 - Full side view, adipose fin visible.					x	x

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Osmerus mordax</i>	Rainbow Smelt	Fin clips needed from ON and MB		1 - Full side view, adipose fin visible.	x	x				
<b>Salmonidae (Trouts and Salmons)</b>										
<i>Coregonus artedi</i>	Cisco	Yes			x	x	x	x	x	x
<i>Coregonus autumnalis</i>	Arctic Cisco	Yes							x	x
<i>Coregonus clupeaformis</i>	Lake Whitefish		< 40 mm	1 - Full side view. 2 - Close-up side view of head.	x	x	x	x	x	x
<i>Coregonus hoyi</i>	Bloater	Yes			x					
<i>Coregonus johannaee</i>	Deepwater Cisco	Yes			x					
<i>Coregonus kiyi</i>	Kiyi	Yes			x					
<i>Coregonus nasus</i>	Broad Whitefish	Yes							x	x
<i>Coregonus nigripinnis</i>	Blackfin Cisco	Yes			x					
<i>Coregonus reighardi</i>	Shortnose Cisco	Yes			x					
<i>Coregonus sardinella</i>	Least Cisco	Yes						x	x	x
<i>Coregonus zenithicus</i>	Shortjaw Cisco	Yes			x					
<i>Oncorhynchus clarkii</i>	Cutthroat Trout		< 60 mm	1 - Full side view. 2 - Anal fin extended (especially on juveniles). 3 - Spots on caudal fin. 4 - Close-up of head. 5 - Close-up of inside of mouth showing tongue and gums. 6 - Close-up of lower jaw showing "cutthroat" marking.				x		
<i>Oncorhynchus gorboscha</i>	Pink Salmon		< 60 mm	1 - Full side view. 2 - Anal fin extended (especially on juveniles). 3 - Spots on caudal fin. 4 - Close-up of head. 5 - Close-up of inside of mouth showing tongue and gums.	x				x	x

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Oncorhynchus kisutch</i>	Coho Salmon		< 60 mm	1 - Full side view. 2 - Anal fin extended (especially on juveniles). 3 - Spots on caudal fin. 4 - Close-up of head. 5 - Close-up of inside of mouth showing tongue and gums.	x				x	
<i>Oncorhynchus mykiss</i>	Rainbow Trout		< 50 mm	1 - Full side view. 2 - Anal fin extended (especially on juveniles). 3 - Spots on caudal fin. 4 - Close-up of head. 5 - Close-up of inside of mouth showing tongue and gums. 6 - Close-up of lower jaw showing absence of "cutthroat" marking.	x	x	x	x	x	
<i>Oncorhynchus nerka</i>	Sockeye Salmon		< 60 mm	1 - Full side view. 2 - Anal fin extended (especially on juveniles). 3 - Spots on caudal fin. 4 - Close-up of head. 5 - Close-up of inside of mouth showing tongue and gums.					x	x
<i>Oncorhynchus tshawytscha</i>	Chinook Salmon		< 60 mm	1 - Full side view. 2 - Anal fin extended (especially on juveniles). 3 - Spots on caudal fin. 4 - Close-up of head. 5 - Close-up of inside of mouth showing tongue and gums.	x			x	x	x
<i>Prosopium coulterii</i>	Pygmy Whitefish	Yes			x			x	x	
<i>Prosopium cylindraceum</i>	Round Whitefish	Yes			x	x	x	x	x	x
<i>Prosopium williamsoni</i>	Mountain Whitefish	Yes						x	x	
<i>Salmo salar</i>	Atlantic Salmon		< 60 mm	1 - Full side view with dorsal fin erect. 2 - Close-up of splayed caudal fin. 3 - Close-up of adipose fin. 4 - Close-up of anal fin depressed against body.	x					x
<i>Salmo trutta</i>	Brown Trout		< 60 mm	2 - Full side view with dorsal fin erect. 2 - Close-up of splayed caudal fin. 3 - Close-up of adipose fin. 4 - Close-up of anal fin depressed against body.	x	x	x	x		

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Salvelinus alpinus</i>	Arctic Char		< 60 mm	1 - Full side view. 2 - Close-up of side of head with mouth closed showing shape of upper jaw.	x	x			x	x
<i>Salvelinus confluentus</i>	Bull Trout		< 60 mm	1 - Full side view. 2 - Close-up of side of head with mouth closed showing shape of upper jaw.				x	x	
<i>Salvelinus fontinalis</i>	Brook Trout		< 40 mm	1 - Full side view. 2 - Close-up of splayed caudal fin.	x	x	x	x		
<i>Salvelinus malma</i>	Dolly Varden		< 60 mm	1 - Full side view. 2 - Close-up of side of head with mouth closed showing shape of upper jaw				x	x	x
<i>Salvelinus namaycush</i>	Lake Trout		< 60 mm	1 - Full side view. 2 - Close-up of splayed caudal fin.	x	x	x	x	x	x
<i>Stenodus leucichthys</i>	Inconnu		< 50 mm	1 - Full side view. 2 - Close-up of head with mouth closed.				x	x	x
<i>Thymallus arcticus</i>	Arctic Grayling		< 50 mm	1 - Full side view.		x	x	x	x	x
<b>Percopsidae (Trout-perches)</b>										
<i>Percopsis omiscomaycus</i>	Trout-perch		< 20 mm	1 - Full side view, adipose fin visible.	x	x	x	x	x	
<b>Gadidae (Cods)</b>										
<i>Lota lota</i>	Burbot		< 40 mm	1 - Full side view with fins erect. 2 - Close-up view of barbel below chin.	x	x	x	x	x	x
<b>Atherinopsidae (New World Silversides)</b>										
<i>Labidesthes sicculus</i>	Brook Silverside		< 40 mm	1 - Full side view.	x					
<b>Fundulidae (Topminnows)</b>										
<i>Fundulus diaphanus</i>	Banded Killifish		< 40 mm	1 - Full side view.	x	x				
<i>Fundulus notatus</i>	Blackstripe Topminnow		< 40 mm	1 - Full side view.	x					
<b>Gasterosteidae (Sticklebacks)</b>										
<i>Apeltes quadracus</i>	Fourspine Stickleback		< 20 mm	1 - Full side view, dorsal spines erect.	x					
<i>Culaea inconstans</i>	Brook Stickleback		< 20 mm	1 - Full side view.	x	x	x	x	x	
<i>Gasterosteus aculeatus</i>	Threespine Stickleback		< 20 mm	1 - Full side view, dorsal spines erect.	x	x		x	x	x

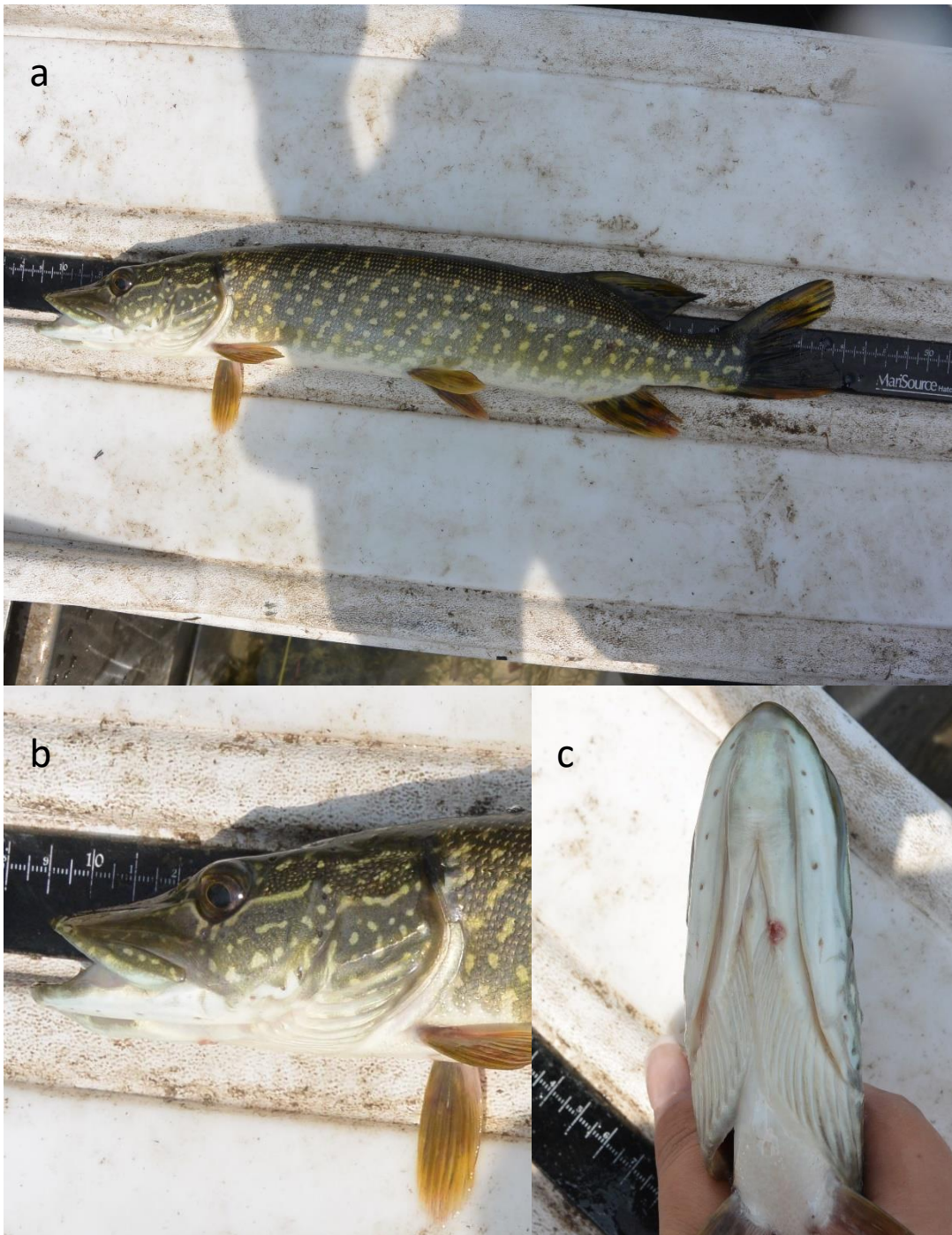
Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Pungitius pungitius</i>	Ninespine Stickleback		< 20 mm	1 - Full side view, dorsal fins erect.	x	x	x	x	x	x
<b>Cottidae (Sculpins)</b>										
<i>Cottus asper</i>	Prickly Sculpin	Yes						x		
<i>Cottus bairdii</i>	Mottled Sculpin	Yes			x	x				
<i>Cottus cognatus</i>	Slimy Sculpin	Yes			x	x	x	x	x	x
<i>Cottus ricei</i>	Spoonhead Sculpin	Yes			x	x	x	x	x	x
<i>Cottus sp.</i>	Rocky Mountain Sculpin	Yes						x		
<i>Myoxocephalus quadricornis</i>	Fourhorn Sculpin	Yes				x			x	x
<i>Myoxocephalus thompsonii</i>	Deepwater Sculpin	Yes			x	x	x	x	x	x
<b>Moronidae (Temperate Basses)</b>										
<i>Morone americana</i>	White Perch		< 50 mm	1 - Full side view. 2 - Close-up of erect anal fin clearly showing anal spines and number of soft rays. 3 - Close-up of join between dorsal fins when spiny dorsal is erect.	x					
<i>Morone chrysops</i>	White Bass		< 50 mm	2 - Full side view. 2 - Close-up of erect anal fin clearly showing anal spines and number of soft rays. 3 - Close-up of join between dorsal fins when spiny dorsal is erect.	x	x				
<b>Centrarchidae (Sunfishes and Basses)</b>										
<i>Ambloplites rupestris</i>	Rock Bass		< 20 mm	1 - Full side view. 2 - Close-up view of anal fin with spines erect.	x	x	x			
<i>Lepomis cyanellus</i>	Green Sunfish		< 40 mm	1 - Full side view, fins erect.	x					
<i>Lepomis gibbosus</i>	Pumpkinseed		< 40 mm	1 - Full side view, dorsal fins erect.	x	x				
<i>Lepomis gulosus</i>	Warmouth		< 40 mm	1 - Full side view that shows body profile as well as fins and side pigmentation. 2 - Close-up side view of head. 3 - Close-up view of dorsal fins. 4 - Close-up view of anal fin with spines erect.	x					

Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Lepomis humilis</i>	Orangespotted Sunfish		< 40 mm	1 - Full side view, dorsal fins erect. 2 - Close-up view of head showing pores.	x					
<i>Lepomis macrochirus</i>	Bluegill		< 40 mm	1 - Full side view, dorsal fins erect.	x	x				
<i>Lepomis peltastes</i>	Northern Sunfish		< 40 mm	1 - Full side view, dorsal fins erect.	x					
<i>Micropterus dolomieu</i>	Smallmouth Bass		< 20 mm	1 - Full side view (mouth closed), dorsal fins erect.	x	x	x			
<i>Micropterus salmoides</i>	Largemouth Bass		< 20 mm	1 - Full side view (mouth closed), dorsal fins erect.	x	x	x			
<i>Pomoxis annularis</i>	White Crappie		< 50 mm	1 - Full side view, dorsal and anal fins erect.	x	x				
<i>Pomoxis nigromaculatus</i>	Black Crappie		< 50 mm	1 - Full side view, dorsal and anal fins erect.	x	x				
<b>Percidae (Perches and Darters)</b>										
<i>Ammocrypta pellucida</i>	Eastern Sand Darter		< 40 mm	1 - Full side view showing fins and side markings.	x					
<i>Etheostoma blennioides</i>	Greenside Darter		< 40 mm	1 - Full side view. 2 - Spiny dorsal fin erect.	x					
<i>Etheostoma caeruleum</i>	Rainbow Darter		< 40 mm	1 - Full side view. 2 - Spiny dorsal fin erect.	x					
<i>Etheostoma exile</i>	Iowa Darter		< 40 mm	1 - Full side view. 2 - Spiny dorsal fin erect.	x	x	x	x		
<i>Etheostoma flabellare</i>	Fantail Darter		< 40 mm	1 - Full side view. 2 - Spiny dorsal fin erect.	x					
<i>Etheostoma microperca</i>	Least Darter		< 20 mm	1 - Full side view. 2 - Spiny dorsal fin erect.	x					
<i>Etheostoma nigrum</i>	Johnny Darter	Yes, from Lake Ontario/St. Lawrence drainage		1 - Full side view. 2 - Spiny dorsal fin erect.	x	x	x			
<i>Etheostoma olmstedi</i>	Tessellated Darter	Yes, from Lake Ontario/St. Lawrence drainage		1 - Full side view. 2 - Spiny dorsal fin erect.	x					
<i>Gymnocephalus cernua</i>	Ruffe	Yes			x					
<i>Perca flavescens</i>	Yellow Perch		< 40 mm	1 - Full side view.	x	x	x	x	x	



Scientific Name	Common Name	Preserved Specimen Essential	Size where Preservation Essential	Photography Recommended	ON	MB	SK	AB	NWT	NU
<i>Percina caprodes</i>	Logperch		< 40 mm	1 - Full side view showing fins. 2 - Close-up side view of head	x	x	x	x		
<i>Percina copelandi</i>	Channel Darter	Yes			x					
<i>Percina maculata</i>	Blackside Darter		< 40 mm	1 - Full side view.	x	x	x			
<i>Percina shumardi</i>	River Darter	Yes			x	x	x			
<i>Sander canadensis</i>	Sauger		< 60 mm	1 - Full side view. 2 - Dorsal fin extended. 3 - Lower lobe of caudal fin visible.	x	x	x	x		
<i>Sander vitreus</i>	Walleye		< 60 mm	1 - Full side view. 2 - Dorsal fin extended. 3 - Lower lobe of caudal fin visible.	x	x	x	x	x	
<b>Sciaenidae (Drums and Croakers)</b>										
<i>Aplodinotus grunniens</i>	Freshwater Drum		< 40 mm	1 - Full side view.	x	x				
<b>Gobiidae (Gobies)</b>										
<i>Neogobius melanostomus</i>	Round Goby		< 40 mm	1 - Full side view, dorsal fins erect. 2 - Close-up view of fused pelvic fins on ventral surface.	x					
<i>Proterorhinus semilunaris</i>	Tubenose Goby		< 50 mm	1 - Full side view, dorsal fins erect. 2 - Close-up view of fused pelvic fins on ventral surface. 3 - Close-up of tubular nostrils.	x					

## FIGURES



*Figure 1. Complete digital voucher series. Photos of a Northern Pike (Esox lucius) display all features listed in Table 1 required to properly identify the species: (a) full side view; (b) close-up side view of head showing suborbital bar and cheek scalation (fully scaled cheek, partially scaled opercula); (c) ventral view of bottom jaw showing sub-mandibular pores (10 pores). Photo credit: DFO's Asian Carp Program.*



*Figure 2. Use of viewing aquaria. Fish viewing aquaria allow fins to be fully splayed, such that rays/spines can be easily counted and pigmentation is visible. Aquaria also reduce the handling time for fishes. Photographing fish through plexiglass may require additional practice to optimize settings, and images are best when source water is not turbid. Photo credit: DFO's Biodiversity Science lab.*

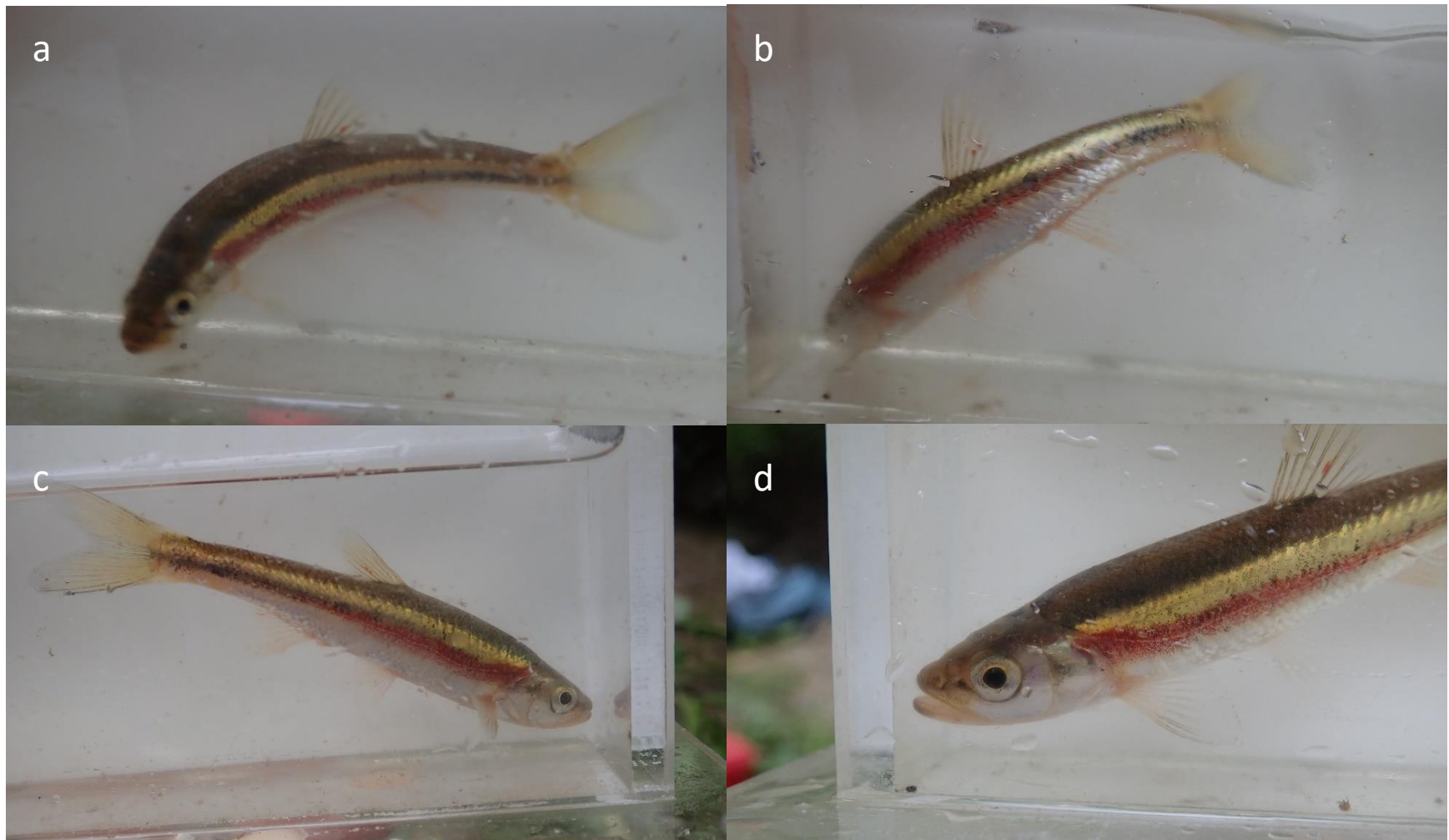


Figure 3. It is preferable to take multiple photos to document relevant features, which is especially important for active specimens. Do not delete multiple photos; photo (b) provides the clearest view of the anal fin allowing rays to be easily counted if needed. Photos of a Redside Dace (*Clinostomus elongatus*) listed as Endangered under Canada's Species at Risk Act. Photos (c) a full side viewing showing fins and side colouration and (d) close-up side view of the head showing the mouth size together constitute a complete digital voucher series for this species. Photo credit: DFO's Biodiversity Science lab.



*Figure 4. A single side view is rarely sufficient to differentiate a specimen from similar species. Photo of a Common Shiner (*Luxilus cornutus*). This specimen could not be repeatedly identified as a Common Shiner and distinguished from the similar Striped Shiner (*Luxilus chrysocephalus*) from this photo alone. Table 1 indicates that a close-up dorsal view of the head to dorsal fin origin is required to count dorso-lateral scales (16-30 in the Common Shiner vs. 13-19 in the Striped Shiner), and a close-up view of the chin is required to see pigmentation. Additional photos of the mouth shape and anal fin rays would provide more confidence. A specimen of this size (45 mm total length) should be preserved to ensure all features needed to distinguish from similar species are verifiable. See Figure 6 for an example of a quality and complete digital voucher of Striped Shiner. Photo credit: DFO's Asian Carp Program.*



*Figure 5. Example of failing to use the camera's playback feature to assess quality of digital voucher photos in the field. Photos of a Striped Shiner (*Luxilus chrysocephalus*) where photos of a relevant feature (pre-dorsal scales) needed to distinguish from similar species were attempted, but are of poor quality, with issues such as (a) camera out of focus, (b) condensation on the lens, (c) finger casting a shadow over the pre-dorsal scales making them difficult to count. See Figure 6 for an example of a quality digital voucher of Striped Shiner. Photo credit: DFO's Asian Carp Program.*



*Figure 6. Suitable digital voucher photos of Striped Shiner (*Luxilus chrysocephalus*), which display the features listed in Table 1 required to properly identify the species: (a) full side view showing mouth size and shape (note\* mouth closed), forked caudal fin, clear origins of dorsal and pelvic fins; (b) close-up dorsal view of the head to dorsal fin origin allowing pre-dorsal scales to be counted; camera is properly focused with uniform lighting. Note: Close-up view of the chin is missing to complete the series. Photo credit: DFO's Asian Carp Program.*



Figure 7. Examples of relevant features not displayed. Photos showing Common Carp (*Cyprinus carpio*) of approximately the same size (~110 mm total length) where the relevant features (serrated dorsal and anal spines and two pairs of barbels) are not properly displayed in either panel (a,b). Additionally, photo (a) is taken in a shadow making features on the head dark and difficult to see. Photo credit: DFO's Asian Carp Program.





*Figure 8. Example of a common auto-focus issue: photos showing a Blackchin Shiner (*Notropis heterodon*), where the camera's auto-focus settings were used (a), and where manual focusing was used (b). Note that Blackchin Shiner specimens should be preserved, but the photo is intended to highlight a common photography issue. Photo credit: DFO's Asian Carp Program.*



*Figure 9. Example of common camera issue, where condensation on the lens is obscuring key details. Photo showing a Common Carp (Cyprinus carpio). Although the species is recognizable at this size, condensation on the lens obscures details. Additionally, placement of the dipnet covers the mouth and barbels and the fish does not fill the frame of the camera. Photo credit: DFO's Asian Carp Program.*

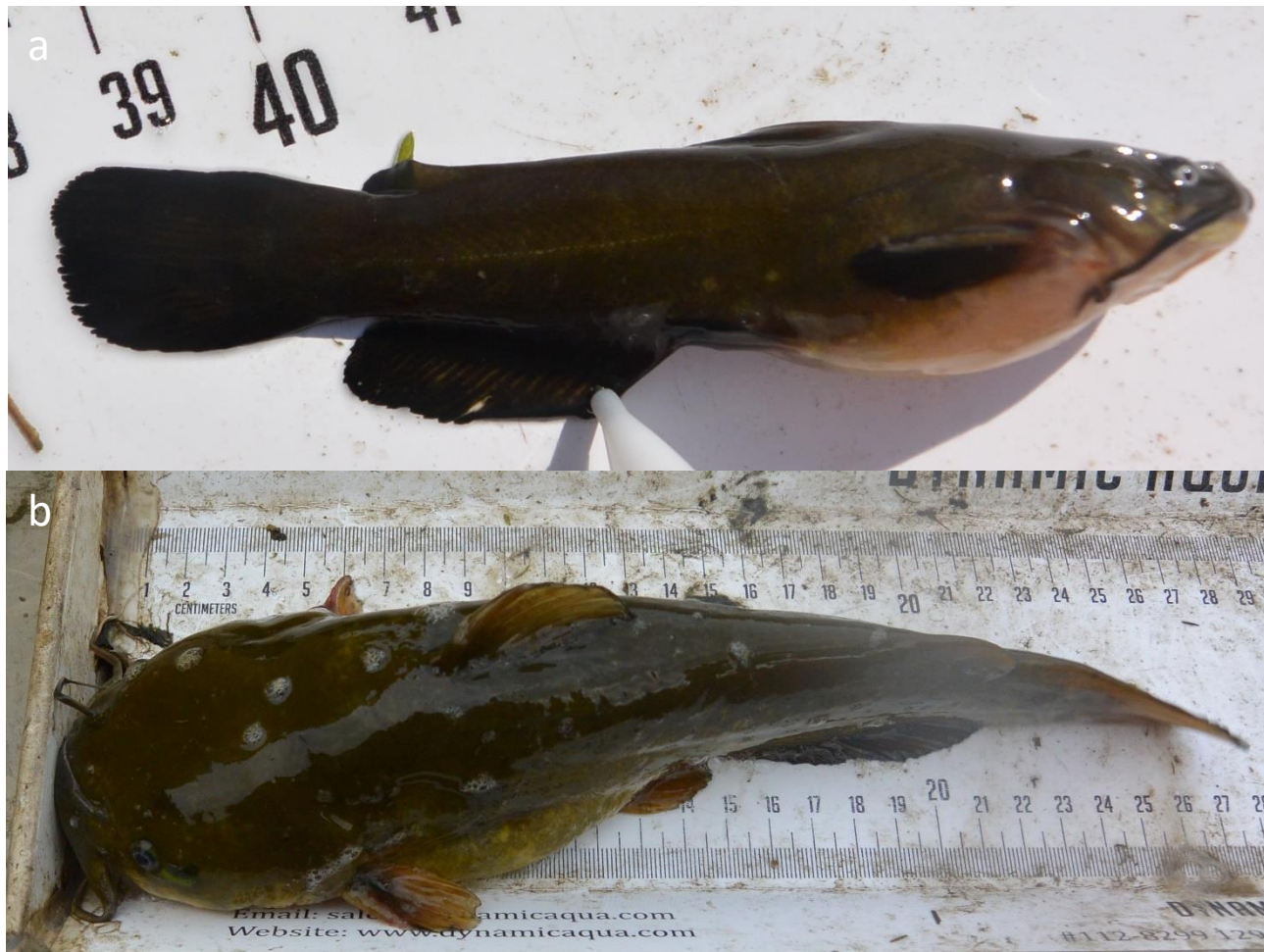


Figure 10. Example of poor quality digital vouchers. Photos of two Yellow Bullhead (*Ameiurus natalis*). Issues are (a) unable to count anal rays due to shadows, issues with focus related to small size (specimen should be preserved), (b) the angle of the photo does not show the barbels, anal fin, or shape of caudal fin; difficult to see the attachment of the adipose fin because of a water spot on the lens. See Figure 11 for an example of a quality, complete Yellow Bullhead digital voucher series. Photo credit: DFO's Asian Carp Program.



Figure 11. Example of a good quality digital voucher series. Photos of a Yellow Bullhead (*Ameiurus natalis*) display all features listed in Table 1 required to properly identify the species: (a) close-up ventral view of the head showing the pale barbels from the base, (b) a full side view showing the detached adipose fin, the square caudal fin, the lower jaw not protruding, and an additional photo (c) with anal and caudal fins fully splayed. The lighting is uniform across all three photos. Photo credit: DFO's Asian Carp Program.