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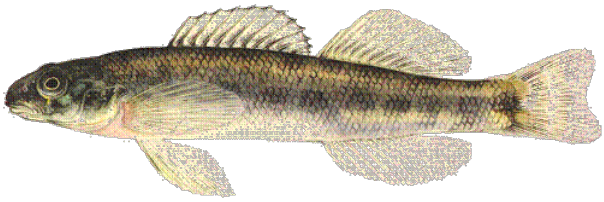
Science Advisory Report 2020/033

RECOVERY POTENTIAL ASSESSMENT OF CHANNEL DARTER (*PERCINA COPELANDI*) IN CANADA, LAKE ERIE (DU1) AND LAKE ONTARIO (DU2) POPULATIONS



*Channel Darter (*Percina copelandi*). Illustration by Ellen Edmonson, reproduced with permission.*

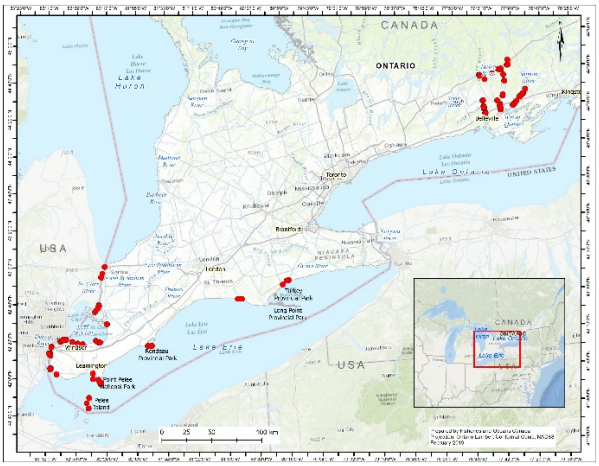


*Figure 1. Distribution of Channel Darter (*Percina copelandi*) DU1 and DU2 Populations in Canada.*

Context:

In May 2002, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Channel Darter as Threatened based on low population sizes where the species is found and habitat perturbations involving fluctuations in water temperature and siltation (COSEWIC 2002). The species was subsequently listed as Threatened under Schedule 1 of the Species at Risk Act (SARA). However, the species' disjunct distribution (> 300 km of geographic separation between populations in Lake Erie, Lake Ontario, and the St. Lawrence River), along with genetic evidence indicating that dispersal among rivers is limited (Reid et al. 2013, COSEWIC 2016), prompted COSEWIC to re-assess Channel Darter in November 2016 into three designatable units (DU): Lake Erie (considers lacustrine populations in Lake Erie and lacustrine and riverine populations within the Huron-Erie corridor; DU1); Lake Ontario (considers riverine populations within the Bay of Quinte drainage; DU2); and, St. Lawrence populations (DU3). Both DU1 and DU2 were re-assessed by COSEWIC as Endangered. For DU1, the reason for designation provided by COSEWIC was that "This small-bodied species occupies nearshore lake and river habitats that are undergoing major shoreline modifications and the negative impact of the invasive Round Goby, having resulted in likely extirpation from large areas of Lake Erie and Lake St. Clair" (COSEWIC 2016). Similarly, the rationale for the designation of Endangered within DU2 was that "This small-bodied species is limited to three small watersheds. The primary threat is the invasive Round Goby, which is now found throughout the Trent River and has resulted in declines in the abundance of this population. For the time being, populations along the Moira and Salmon rivers are largely unaffected by Round Goby. However, introductions upstream of dams via bait bucket transfers are considered likely" (COSEWIC 2016).

A species Recovery Potential Assessment (RPA) process has been developed by Fisheries and Oceans Canada (DFO) Science to provide the information and scientific advice required to meet the various requirements of the SARA, such as the authorization to carry out activities that would otherwise

violate the SARA as well as the development of recovery strategies. The scientific information also serves as advice to the Minister of DFO regarding the listing of the species under SARA and is used when analyzing the socio-economic impacts of adding the species to the list as well as during subsequent consultations, where applicable. In light of the revised DU structure, this document evaluates the distribution, abundance, population trends, habitat requirements, threats, and new research findings following the 2010 RPA, focusing on differences between Channel Darter DUs 1 & 2.

This Science Advisory Report is from the July 9th, 2019 Recovery Potential Assessment – Channel Darter, Percina copelandi*, Lake Erie (Designatable Unit 1) and Lake Ontario (Designatable Unit 2) Populations. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.*

SUMMARY

- The November 2016 COSEWIC re-assessment of Channel Darter (*Percina copelandi*) prompted DFO to re-evaluate certain elements of the 2010 Recovery Potential Assessment (RPA) with respect to the revised designatable unit (DU) structure. This RPA summarizes additional research on Channel Darter DUs 1 & 2 that has been undertaken since the 2010 RPA (Bouvier and Mandrak 2010).
- There are six locations where Channel Darter is known to occur in the Lake Erie designatable unit (DU1): Detroit River, St. Clair River, Lake St. Clair, Lake Erie Western basin (restricted to the confluence of the Detroit River with Lake Erie and the Point Pelee area), and Lake Erie Central basin (Rondeau Bay and Port Burwell).
- In the Lake Ontario designatable unit (DU2), Channel Darter is known from the Trent River (from Glen Ross to the town of Trenton), the Moira River system (including tributaries Skootamatta and Black rivers), and the Salmon River (from Kingsford to Shannonville).
- Adult Channel Darter inhabit small to large sized rivers or connecting channels with moderate current, and nearshore areas of large lakes with gravel or coarse-sand beaches.
- Lake Ontario (DU2) populations are riverine and confined to tributaries of eastern Lake Ontario, while Lake Erie (DU1) populations are primarily lacustrine, relying on nearshore beach habitat of large lakes, but also reside within the flowing waters of connecting channels.
- Spawning occurs from late May to July in areas dominated by cobble and gravel.
- Four of five Lake Erie populations (DU1) have been assigned a population status of Poor while two out of three Lake Ontario (DU2) populations were assigned a population status of Good.
- The greatest threats to Channel Darter are altered flow regimes and the invasion of Round Goby. Multiple dams alter flow in the Trent and Moira River systems in DU2; flow-related impacts to spawning have been documented. Round Goby is pervasive throughout much of the occupied range of Channel Darter in DU1 and 2. Round Goby is anticipated to compete directly with Channel Darter for food resources; behavioural effects and spawning interference may also occur. For DU1, shoreline modifications may also degrade Channel Darter habitats. Common shoreline modifications include the creation of docks, jetties, marinas, breakwaters, and groynes, which have occurred on the north shore of Lake Erie.

BACKGROUND

In May 2002, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Channel Darter (*Percina copelandi*) as Threatened. The species was re-assessed by COSEWIC in November 2016 as having three designatable units (DU): Lake Erie, DU1 (Endangered), Lake Ontario, DU2 (Endangered), and the St. Lawrence River, DU3 (Special Concern). Rationale for the revised DU structure was based on evidence of local extirpations contributing to greater geographic separation (> 300 km) between Erie and Ontario populations; and, evidence of genetic distinctiveness between Lake Erie, Lake Ontario, and the St. Lawrence River.

When COSEWIC designates an aquatic species as Threatened or Endangered and the Governor in Council decides to list the species, the Minister of Fisheries and Oceans Canada (DFO) is required by SARA to undertake a number of actions. Many of these actions require scientific information about the current status of the population, the threats to survival and recovery, and the feasibility of recovery. Scientific advice is developed through a Recovery Potential Assessment (RPA), which allows for the consideration of peer-reviewed scientific analyses in subsequent SARA processes, including permitting on harm and recovery planning.

A Recovery Potential Assessment was previously conducted for Channel Darter in 2010; however, this Science Advisory Report summarizes the current state of the species including its distribution, abundance, population trends, habitat requirements, and threats, noting differences between DU1 and DU2 and new research findings following the 2010 RPA. The research document (Andrews and Drake, 2020) provides an in-depth account of the information summarized below. Proceedings of key discussions of the meeting are also available (DFO 2020). Due to the lack of new information regarding life history parameters of Channel Darter, recovery potential modelling was not updated in this RPA. For the most recent estimates of allowable harm and recovery targets, see Venturelli et al. (2010).

ASSESSMENT

Lake Erie Designatable Unit (DU1)

In DU1, Channel Darter is known from nearshore areas of Lake St. Clair and Lake Erie, as well as connecting channels of the Huron-Erie corridor (St. Clair River and the Detroit River; Figure 1). An overview of current status and collection records is provided below.

Current Status - Lake Erie Designatable Unit (DU1)

There are six locations where Channel Darter is currently known to occur in the Lake Erie designatable unit (DU1): Detroit River, St. Clair River, Lake St. Clair, Lake Erie Western basin (restricted to the confluence of the Detroit River with Lake Erie and the Point Pelee area), Rondeau Bay, and Port Burwell. A population in the Lake Erie Eastern Basin near Port Dover was last detected in 1947 but is presumed extirpated (COSEWIC 2016).

Detroit River: Channel Darter was first collected from the Detroit River in 1940 (COSEWIC 2016), with the most recent captures in 2013 from untargeted surveys (32 individuals; DFO unpublished data; Figure 1).

St. Clair River: The St. Clair River population has been poorly studied. Since individuals were first collected from the St. Clair River in 1996, they have only been captured on two occasions (2013 and 2014). During this two year period, non-target surveys captured 12 individuals from 5 sites (DFO unpublished data).

Lake St. Clair: Channel Darter was collected in Lake St. Clair as early as 1980. Targeted sampling during the 2000s (2004-2005 and 2007-2010) failed to detect the species but one individual was captured in 2012 (DFO unpublished data).The 2012 collection is the only record of Channel Darter from this locality since 1996.

Western Lake Erie: Historically, Channel Darter occurred at Holiday Beach, Pelee Island, and the Point Pelee area. Populations from Holiday Beach and Pelee Island may be extirpated as the species has not been detected there since 1997 and 1984, respectively (COSEWIC 2016). The last detection from Point Pelee was in 2010, when 50 individuals were captured (COSEWIC 2016).

Rondeau Bay: Channel Darter was initially detected at Rondeau Bay in 1951–53 (Bouvier and Mandrak 2010), but a lack of repeat detections suggested that extirpation had occurred. However, in 2018, 27 individuals were captured by the Ontario Ministry of Natural Resources and Forestry (OMNRF) (LeBaron et al. in press).

Port Burwell: Channel Darter was first collected near Port Burwell in 1950 and 1951. No individuals were observed thereafter until a single Channel Darter was captured in 2017 near the mouth of Big Otter Creek (DFO unpublished data). The recent Rondeau Bay (2018) and Port Burwell (2017) collections represent the only known occurrences of Channel Darter in the central basin of Lake Erie since 1953.

Port Dover: Channel Darter was last observed near Port Dover in 1947 and is presumed extirpated.

Lake Ontario Designatable Unit (DU2)

In DU2, Channel Darter has been collected from the Trent River (from Glen Ross to the town of Trenton), the Moira River system (including tributaries Skootamatta and Black rivers), and Salmon River (from Kingsford to Shannonville) (Figure 1). The only possible extirpation that has occurred within DU2 is in an unnamed creek near Moira Lake (COSEWIC 2016).

Current Status - Lake Ontario Designatable Unit (DU2; Bay of Quinte Drainage).

Trent River: Channel Darter was initially detected in the Trent River in 1976. OMNRF has regularly targeted and captured this species in research surveys since 2001 From 2012-18, 1,592 individuals were captured in targeted surveys by OMNRF (OMNRF unpublished data).

Salmon River: Channel Darter was initially detected in the Salmon River in 2003, as reported in Reid et al. (2005). The last known detection of Channel Darter in the Salmon River occurred in 2014, when 30 individuals were captured (OMNRF unpublished data).

Moira System: Channel Darter was initially detected in the Moira River system (Moira, Skootomatta, and Black rivers) as early as 1948, when two individuals were collected from an unnamed creek near Moira Lake. The capture of Channel Darter has occurred as recently as 2014 (DFO unpublished data). Sampling of the Moira River in 2013 captured 25 individuals (Reid and Haxton 2017).

Population Assessment

To assess the population status of Channel Darter (DU1 & 2), each population was ranked in terms of its abundance (Relative Abundance Index) and trajectory (Population Trajectory; Table 1). The Relative Abundance Index was assigned as Extirpated, Low, Medium, High or Unknown based on sampling that has occurred since the 2010 RPA (i.e., 2010 onwards). The evaluation of population status considered detections of Channel Darter in relation to sampling effort and

gear used, area sampled, and whether the study was targeting Channel Darter. The number of individual Channel Darter caught during each sampling period was then considered when assigning the Relative Abundance Index. The Relative Abundance Index is a relative parameter in that the values assigned to each population are relative to the most abundant population. In the case of Channel Darter, all populations were assessed relative to the Trent River. Catch data from populations sampled using different gears were assumed to be comparable when assigning the Relative Abundance Index.

The Population Trajectory was assessed as Decreasing, Stable, Increasing, or Unknown for each population based on the best available knowledge about the current trajectory of the population. The number of individuals caught over time for each population was considered. Trends were classified as Increasing (an increase in abundance over time), Decreasing (a decrease in abundance over time) and Stable (no change in abundance over time). If insufficient information was available to inform the Population Trajectory, the population was listed as Unknown. Refer to Andrews and Drake (2020) for detailed methods used to assess Population Status.

Table 1. Population Status for Channel Darter (DU1 & 2) populations in Ontario, resulting from both the Relative Abundance Index and Population Trajectory. Certainty assigned to each Population Status is reflective of the lowest level of certainty associated with either initial parameter (Relative Abundance Index, or Population Trajectory).

Population	Population Status	Certainty
DESIGNATABLE UNIT 1		
Lake Erie Western basin: Pelee Island, Point Pelee, Holiday Beach	Unknown	3
Lake Erie Central/Eastern basin: Port Dover, Port Burwell, Rondeau Bay	Poor	3
Detroit River	Poor	3
St. Clair River	Poor	3
Lake St. Clair	Poor	3
DESIGNATABLE UNIT 2		
Trent River	Fair	2
Salmon River	Good	2
Moira system: Moira, Skootamatta and Black Rivers	Good	2

Habitat Requirements

Adult Channel Darter inhabit small to large sized rivers or connecting channels with moderate current and nearshore areas of lakes with gravel or coarse-sand beaches (Bouvier and Mandrak 2010). Lake Ontario (DU2) populations are riverine and confined to tributaries of eastern Lake Ontario, while Lake Erie (DU1) populations are primarily lacustrine, relying on nearshore beach habitat of large lakes, but also occupy the flowing waters of connecting channels. Within both DU's, Channel Darter can be found in a variety of habitats including coarse sand beaches, riffles, shoals, and pools (Reid et al. 2005, Bouvier and Mandrak 2010). Coarse substrates, such as cobble and gravel, are common in areas occupied by Channel Darter, especially in rivers (Reid et al. 2005, Reid et al. 2016). Fine particles such as silt and organic material are rarely used by adults. Much of the information about Channel Darter habitat is based on the collection of adults during the summer months. Very little is known about juvenile habitat use or the habitat features used by Channel Darter during winter (COSEWIC 2016).

Channel Darter is believed to migrate short distances to access spawning shoals and riffle habitat (Winn 1953). Spawning occurs in June in Ontario in areas with coarse substrate dominated by cobble and gravel; however, the species has also been observed spawning near larger rocks (Lane et al. 1996a, Bouvier and Mandrak 2010, Reid et al. 2016). Water temperature during spawning ranged from 14 – 26 °C in Ontario and Quebec (Comtois et al. 2004, Reid 2004). In the Trent River, Channel Darter were associated with water depths from 0.1 – 0.4 m and water temperatures ranged from 19 – 27 °C (Reid et al. 2016) during the spawning period.

Functions, Features and Attributes

A description of the functions, features, and attributes associated with Channel Darter DU1 and DU2 habitat can be found in Table 2. The habitat required for each life stage has been assigned a function that corresponds to a biological requirement of Channel Darter. For example, individuals in the larval to juvenile life stage require habitat for nursery and spawning purposes. In addition to the habitat function, a feature has been assigned to each life stage. A feature is considered to be the structural component of the habitat necessary for the survival or recovery of the species. Habitat attributes have also been provided, describing how the features support the function for each life stage. This information is provided to guide the future identification of critical habitat for this species.

Table 2. Summary of the essential functions, features, and attributes for each life stage of Channel Darter. Habitat attributes from published literature and those measured during Channel Darter surveys have been combined to derive the habitat attributes required for the delineation of critical habitat (see text for a detailed description of categories).

			Habitat Attributes		
Life Stage	**Function**	**Features**	**Scientific Literature**	**Current Records**	**For Identification of Critical Habitat**
Spawn to Hatch	Spawning Cover Nursery	Riffle and shoal habitats	• Spawning has been observed at temperatures ranging from 14°C to 26°C (Comtois et al. 2004, Reid 2004) • Spawns on gravelly shoals in Michigan lakes (Winn 1953), but also near large rocks (Lane et al. 1996a)	• Spawning occurs from May to mid-July in the Trent River (DFO 2016) • Mid-column water velocities of 0.46 m/s (range 0 – 1.0), mean water depths of 0.49 m (range 0.23 – 0.77), and coarse substrate (21% gravel, 64% cobble) were found in areas containing gravid females in the Trent River (Reid 2004, Reid et al. 2016)	For DU1 lacustrine populations • Coarse sand – fine gravel beaches For DU2 • Riffles and shoals with moderate flow • Cobble and gravel substrates • Known from depths < 1m • Flow velocity 0 – 1 m/s
YOY/ Juvenile (age 1 until sexual maturity)	Feeding Cover Nursery Winter refugia	Riffles, shoals, pools	• Strong association with gravel and sand and moderate association with silt substrates (Lane et al. 1996b) • Depths ranging from 0 – 5+ m (Lane et al. 1996b). • Juveniles (fish < 35 mm TL) likely used coarse sand-fine gravel beaches at Point Pelee (inferred from Reid and Mandrak 2008)	• None available	• Unknown
Adult	Feeding Cover	Riffles, shoals, coarse-sand	• For Lake Ontario tributaries, avg. depth = 0.35 m, avg. width = 21.3 m, avg. flow	For DU1 (riverine populations) • Mean substrate (percent	For DU1 (lacustrine populations) • Coarse sand – fine

			Habitat Attributes		
Life Stage	**Function**	**Features**	**Scientific Literature**	**Current Records**	**For Identification of Critical Habitat**
		beaches, pools	velocity = 0.34 m/s, avg. conductivity = 239.2, median particle size = 123 mm (Reid et al. 2005)	composition of site) as follows: 32% sand, 32% clay, 20% silt, 7% gravel, 5% boulder, 4% organic (n = 20; DFO unpublished data) • $\bar{x}$ DO = 9.99 mg/L $\bar{x}$ water temp = 18.1 °C $\bar{x}$ Turbidity = 5.43 ntu $\bar{x}$ Stream depth = 4.1 m (1.7 – 5.3 m) $\bar{x}$ stream velocity = 0.22 m/s ○ n = 30; DFO unpublished data) For DU2 • Avg. water velocity of 0.32 m/s in Trent River (Reid 2019) • Avg. depth of 0.42 m in Trent River (Reid 2019) • Riffles flowing into deep pool or run habitats (Reid et al. 2005)	gravel beaches For DU1 riverine populations • Known from water depths of less than 6 m • Water velocity ranging between 0.03 – 0.57 m/s (DFO unpublished data) For DU2 • Riffles and shoals with depth less than 1 m and flow less than 1 m/s • Coarse sand, gravel and cobble
Adult	Winter refugia	Coarse-sand beaches, pools	• None available	• None available	Unknown

Threats

The greatest threat to Channel Darter DUs 1 & 2 is altered flow regimes. There are multiple dams that alter flow in the Trent and Moira River systems for the purposes of navigation, public safety, and flood control. Altered flows can result in dewatering of spawning habitat or failure to initiate spawning. Channel morphology alterations by way of dredging and water-level compensating works has altered historical flow regimes in the Detroit River and has led to the loss of spawning habitat for several fishes (Bennion and Manny 2011). For DU1, shoreline modifications also pose a threat to the habitat required by Channel Darter. Shoreline modification includes activities such as the creation of docks, jetties, marinas, breakwaters, and groynes that are common on the north shore of Lake Erie, all of which lead to shoreline hardening. These activities have been shown to alter nearshore sediment transport, which has negatively impacted Channel Darter habitat through the deposition of fine substrates. These threats may be amplified by the effects of climatic change including increased water temperatures, decreased water levels, and increased frequency of extreme weather events.

Threat Level Assessment

To assess the Threat Level of Channel Darter DUs 1 & 2, each threat was ranked in terms of the Threat Likelihood of Occurrence, Threat Level of Impact, and Causal Certainty on a population-by-population basis. Terms used to describe population level threat categories are described in Table 3. Threats were rolled-up to create a DU-level threat assessment in Table 4.

Table 3. Definition and terms used to describe Population Level Threat Occurrence (PTO), Threat Frequency (PTF), and Threat Extent (PTE) information taken from DFO (2014).

Term	Definition
Population-Level Threat Occurrence (PTO)	
Historical (H)	A threat that is known to have occurred in the past and negatively impacted the population.
Current (C)	A threat that is ongoing and is currently negatively impacting the population.
Anticipatory (A)	A threat that is anticipated to occur in the future and will negatively impact the population.
Population-Level Threat Frequency (PTF)	
Single (S)	The threat occurs once.
Recurrent (R)	The threat occurs periodically or repeatedly.
Continuous (C)	The threat occurs without interruption.
Population-Level Threat Extent (PTE)	
Extensive (E)	71-100% of the population is affected by the threat.
Broad (B)	31-71% of the population is affected by the threat.
Narrow (NA)	11-30% of the population is affected by the threat.
Restricted (R)	1-10% of the population is affected by the threat.

Table 4. DU-level Threat Assessment for Channel Darter DU1 & 2 in Canada, resulting from a roll-up of population-level Threat Assessment. DU-level Threat Risk (L = Low, M = Medium, H = High), Threat Occurrence (H = Historical; C = Current; A = Anticipatory), Threat Frequency (S = Single; R = Recurrent; C = Continuous), and Threat Extent (E = Extensive; B = Broad; R = Restricted). The DU-level Threat Extent is calculated as the mode of population-level Threat Extent.

Threat	DU-level Threat Risk		DU-level Threat Occurrence		DU-level Threat Frequency		DU-level Threat Extent	
	DU1	DU2	DU1	DU2	DU1	DU2	DU1	DU2
Turbidity and sediment loading	M	M	H,C	H,C	R,C	R,C	E	E
Contaminant and toxic substances	M	M	H,C	H,C	R,C	R,C	E	E
Nutrient loading	M	L	H,C	H,C	R,C	R,C	E	E
Shoreline modifications	H	L	H	H	R	R	B	NA
Altered flow regimes	H	H	H,C	H,C	R,C	R,C	B	B
Barriers to movement		M		H,C		C		NA*
Exotic species and diseases	H	H	C	C	C	C	E	E
Incidental harvest	L	L	H,C	H,C	R	R	R	R

**Mode could not be calculated*

Mitigations and Alternatives

Threats to species survival and recovery can be reduced by implementing mitigation measures to reduce or eliminate potential harmful effects that could result from works or undertakings associated with projects, or activities in Channel Darter habitat. Within this section, an updated review of works, undertakings, and activities is provided. Mitigations and alternatives to activities that threaten Channel Darter or its habitat have not changed since the previous RPA and therefore are not provided in this document [see Bouvier and Mandrak (2010) for best available mitigations and alternatives].

A variety of works, undertakings, and activities have occurred in Channel Darter habitat in the last five years with project types including: shoreline and streambank works (e.g., stabilization); dredging, infilling and placing structures in water. A review has been completed summarizing the types of work, activity, or projects that have been undertaken in habitat known to be occupied by Channel Darter (Table 5).

The most frequent project types were dredging, shoreline stabilization and shoreline infilling. Based on the assumption that historical and anticipated development pressures are likely to be similar, it is expected that similar types of projects will likely occur in or near Channel Darter habitat in the future. The primary project proponents were adjacent landowners.

There are a number of projects currently proposed that would likely impact Channel Darter, notably hydro retrofits and infrastructure upgrades in the Trent Severn system.

Some threats affecting Channel Darter include shoreline hardening, dredging, and nutrients and effluents from urban waste and spills. Habitat-related threats to Channel Darter can been linked to the Pathways of Effects developed by DFO's Fish and Fish Habitat Protection Program (FFHPP). DFO FFHPP has developed guidance on mitigation measures for 19 Pathways of Effects for the protection of aquatic species at risk in the Central and Arctic Region (Coker et al. 2010). This guidance should be referred to when considering mitigation and alternative strategies for habitat-related threats. For mitigations and alternatives to non-habitat related threats, please see Bouvier and Mandrak (2010).

Table 5. Summary of works, projects and activities that have occurred during the period of April 2014 to April 2019 in areas known to be occupied by Channel Darter. Threats known to be associated with these types of works, projects, and activities have been indicated by a checkmark. The number of works, projects, and activities associated with each Channel Darter population, as determined from the project assessment analysis, has been provided. Applicable Pathways of Effects have been indicated for each threat associated with a work, project or activity (1 - Vegetation clearing; 2 – Grading; 3 –Excavation; 4 – Use of explosives; 5 – Use of industrial equipment; 6 – Cleaning or maintenance of bridges or other structures; 7 – Riparian planting; 8 – Streamside livestock grazing; 9 – Marine seismic surveys; 10 – Placement of material or structures in water; 11 – Dredging; 12 – Water extraction; 13 – Organic debris management; 14 – Wastewater management; 15 – Addition or removal of aquatic vegetation; 16 – Change in timing, duration and frequency of flow; 17 – Fish passage issues; 18 – Structure removal; 19 – Placement of marine finfish aquaculture site).

Work/Project/Activity	**Threats** (associated with work/project/activity)								**Watercourses / Waterbodies** (number of works/projects/activities between April 2014 – April 2019)	
	Habitat removal and alteration	**Nutrient loading**	**Turbidity and sediment loading**	**Contaminants and toxic substances**	**Altered Flow Regime**	**Barriers to Movement**	**Exotic species and disease**	**Incidental harvest**	**DU1**	**DU2**
Applicable pathways of effects for threat mitigation and project alternatives	1, 2, 3, 4, 5, 7, 9, 10, 11, 12,13, 15,18	1, 4, 7, 8, 11, 12, 13, 14, 15, 16	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 18	1, 4, 5, 6 ,7 ,11 ,12 ,13 ,14, 15, 16 ,18	3, 4, 5, 6, 10, 11, 12, 14, 16, 17, 18	3, 4, 5, 6, 10, 11, 12, 14, 16, 17, 18	-	-	-	-
Water crossings (bridges, culverts, open cut crossings)	✓	-	✓	✓	✓	✓	-	-	1	1
Shoreline, streambank work (stabilization, infilling, retaining walls, riparian vegetation management)	✓	-	✓	✓	-		✓	-	18	3
Instream works (channel maintenance, restoration, modifications, realignments, dredging,	✓	✓	✓	✓	✓	✓	✓	-	11	1

Work/Project/Activity	Threats (associated with work/project/activity)								Watercourses / Waterbodies (number of works/projects/activities between April 2014 – April 2019)	
	Habitat removal and alteration	Nutrient loading	Turbidity and sediment loading	Contaminants and toxic substances	Altered Flow Regime	Barriers to Movement	Exotic species and disease	Incidental harvest	DU1	DU2
aquatic vegetation removal)										
Water management (stormwater management, water withdrawal)	-	✓	✓	✓	✓	✓	-	-	0	0
Structures in water (boat launches, docks, effluent outfalls, water intakes, dams)	✓	✓	✓	✓	✓	✓	✓	-	8	2
Baitfishing	-	-	-	-	-	-	-	✓	-	-
Invasive species introductions (accidental and intentional)	-	-	-	-	-	-	✓	-	-	-

Sources of Uncertainty

Sources of uncertainty for Channel Darter in DUs 1 and 2 relate to incomplete knowledge of life history, distribution, abundance, and threats; these uncertainties are highlighted in the federal recovery strategy and previous RPA (DFO 2013, Bouvier and Mandrak 2010). Life history parameters outlined in Bouvier and Mandrak (2010) and Venturelli et al. (2010), such as clutch size, fecundity, age at maturity, and maximum age, need to be evaluated to better understand whether variation exists within and between DUs 1 and 2; however, life history parameters are difficult to obtain without lethal sampling. Further knowledge of the life history of Channel Darter will improve the development of population models and associated recovery targets (Venturelli et al. 2010). A long-term, standardized monitoring program would allow the distribution and abundance of extant populations to be assessed, as well as the identification of spawning sites and overwintering areas. Repeat standardized sampling would help inform estimates of population trajectory and abundance and, pending the capture of early life stages, would inform habitat use by life stage, which is poorly known for juveniles and young of the year. Identifying the causal mechanisms leading to the decline of Channel Darter, including the impacts of Round Goby, barriers to movement, shoreline alterations, contaminants, and climate change, would reduce uncertainty in threat assessment and allow for the cumulative effect of these threats to be evaluated. The feasibility of rehabilitating degraded habitats that once supported Channel Darter populations should also be investigated. Evaluating the extent of past and present suitable habitat would support this process. Factors that may be limiting abundance, such as prey availability, predation, fish community interactions, and disease, are additional sources of uncertainty that require future research.

LIST OF MEETING PARTICIPANTS

Name	Organization/Affiliation
Adrienne Mclean	DFO – Fisheries Protection Program
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Dave Andrews	DFO – Science
Andrew Drake	DFO – Science
Sarah Bailey	DFO – Science (Chairperson)
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Dave Balint	DFO – Species at Risk Management
Amy Boyko	DFO – Species at Risk Management
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Tammie Dobbie	Parks Canada – Point Pelee
Tara Bortoluzzi	Parks Canada – Point Pelee
Valerie Minelga	Parks Canada – Trent Severn
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SOURCES OF INFORMATION

This Science Advisory Report is from the July 9th, 2019 Recovery Potential Assessment – Channel Darter, *Percina copelandi*, Lake Erie (Designatable Unit 1) and Lake Ontario (Designatable Unit 2) Populations. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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Aussi disponible en français :

*MPO. 2020. Évaluation du potentiel de rétablissement des populations de fouille-roche gris (*Percina copelandi*) du lac Érié (UD1) et du lac Ontario (UD2) au Canada. Secr. can. de consult. sci. du MPO, Avis sci. 2020/033.*