Fish Community Survey in the Lower Passaic River and Reference River

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Chapter 1 | Introduction

Background

The Diamond Alkali Superfund Site (DASS) is defined by the United States Environmental Protection Agency (EPA) as the former manufacturing facility at 80-120 Lister Avenue in Newark, New Jersey; the LPRSA, including the 17.4 mile tidal stretch of the river from Dundee Dam to Newark Bay and tributaries; the NBSA including Newark Bay and portions of the Hackensack River, Arthur Kill and Kill van Kull; and the areal extent of contamination.

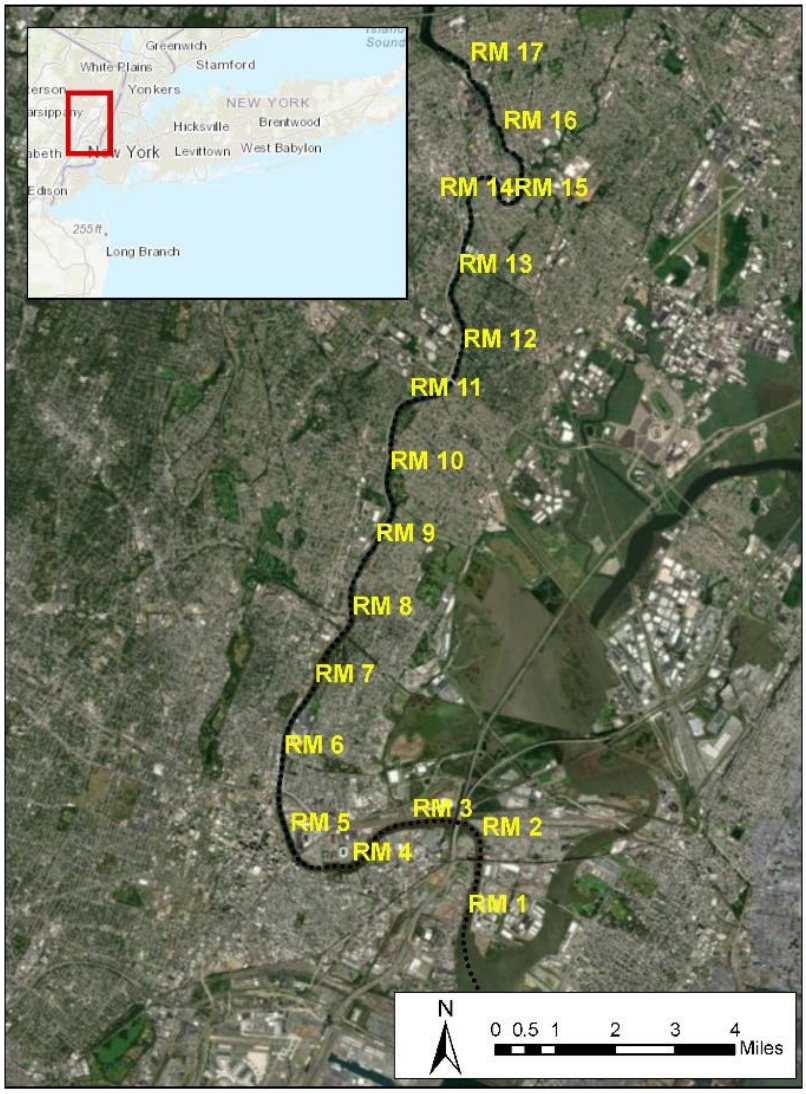
Production of pesticides and other chemical products began at 80 Lister Avenue in the 1940s. In the 1950s and 1960s, the Diamond Alkali Company owned and operated the facility, manufacturing agricultural chemicals, including the herbicides used in the defoliant known as "Agent Orange," among other products. An unwanted by-product of these manufacturing processes was the extremely toxic chemical 2,3,7,8-tetrachlorodibenzo-*para*-dioxin, (2,3,7,8-TCDD and hereinafter referred to as "TCDD"). TCDD is commonly and interchangeably referred to as "dioxin," although dioxin is actually a general name for a large group of chemical compounds with similar structure.

In 1983, environmental sampling by the State of New Jersey and the EPA at and near 80 Lister Avenue and in the river revealed high levels of TCDD and subsequently listed on the Superfund National Priorities List (NPL) in 1984. TCDD, pesticides and other hazardous substances were found in the soil and groundwater at 80-120 Lister Avenue; and TCDD, polychlorinated biphenyls (PCBs), metals, polycyclic aromatic hydrocarbons (PAHs) and pesticides were found in sediment in the Lower Passaic River. Additional sampling would revealed DASS-related hazardous substances throughout Newark Bay and its tributaries, the Hackensack River, Arthur Kill and Kill van Kull.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, 42 U.S.C. § 9601, *et seq*) authorizes designated Natural Resource Trustees, in the instant matter, the U.S. Department of Commerce, acting by and through the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of the Interior, acting by and through the U.S. Fish and Wildlife Service (USFWS), hereinafter referred to as the "Federal Trustees", to act on behalf of the public for the purpose of preparing an injury claim to recover damages from potential responsible parties (PRPs) necessary to restore or replace injured natural resources.

The Lower Passaic River provides habitat for freshwater and estuarine fish species of multiple feeding guilds. Fish surveys conducted over the course of one year in 2009 and 2010 identified forty-five fish species throughout the lower 17.4 miles of the Passaic River (Windward 2019). The Federal Trustees aim to conduct several studies in 2020 to evaluate potential injuries to fish in the Passaic River due to dioxin-like compounds. If injury is deemed likely to have occurred, recent data on fish community presence and abundance will be necessary for damage assessment.

Figure 1. The Lower Passaic River preliminary investigation area.



Preliminary Investigation Goals

The Federal Trustees will conduct this study to determine the presence and relative abundance of fish species utilizing a variety of techniques throughout the lower 17.4 miles of the Passaic River, between the Dundee Dam and the Newark Bay. Fish community surveys have been conducted over a one year period between 2009 and 2010. Although these fish surveys were comprehensive, updated data on the presence and quantity of fish species utilizing the Lower Passaic River is necessary for future injury quantification and restoration scaling. Recent data on target benthic omnivore species to be used in the toxicity studies will enable more accurate estimates of percent effects on populations of those species.

Chapter 2 | Methods and Procedures

Previous Surveys Methods

A variety of sampling methods were used during the 2009 and 2010 fish sampling efforts to target different types of fish, including minnow traps, eel traps, box traps, trotlines, cast nets, dip nets, gillnets, beach seine nets, backpack electrofishers, and boat electrofishers (Windward 2019). Seine nets were deployed in Reaches 1 through 6 (RM 0 to RM 12). Minnow traps and cast nets were used in Reaches 1 through 8 (RM 0 to RM 17.4). And boat and backpack electrofishing were conducted in Reaches 7 and 8 (RM 12 to RM 17.4), respectively.

Catch per unit efforts (CPUEs), or ratio of fish caught for each attempt, for the 2010 early spring/late summer surveys are shown for each trap method and reach in Table 1.

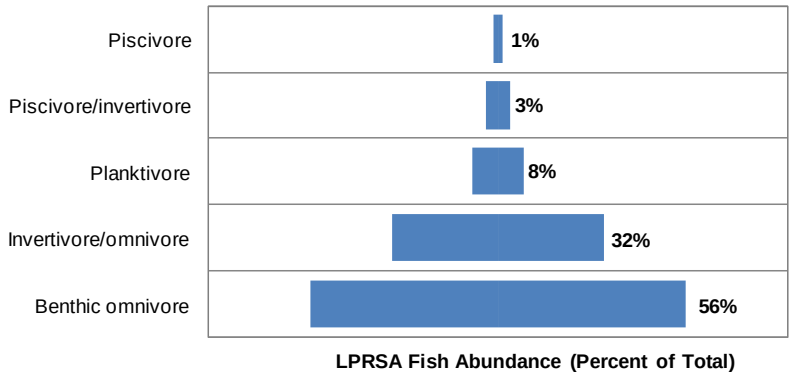
Table 1. Catch per Unit Effort (CPUE) by sampling method and reach for the Lower Passaic River in late spring/early summer 2010 (Windward 2011).

Sampling Method	Reach	Attempts	Total No. of Organisms	CPUE
Backpack electrofishing	8	2	41	21
Boat electrofishing	6	2	4	2
	7	4	13	3.3
	8	2	2	1
Crab trap	1	4	7	1.8
	2	4	11	2.8
	3	4	6	1.5
	4	4	6	1.5
	5	4	9	2.3
	6	4	5	1.3
	7	4	14	3.5
	8	4	11	2.8
Eel trap	1	4	2	0.5
	2	4	0	0
	3	4	0	0
	4	4	0	0
	5	4	1	0.25
	6	4	1	0.25
	7	4	1	0.25
	8	4	3	0.75
Gillnet	1	4	11	2.8
	2	4	57	14.3
	3	4	166	41.5
	4	4	165	41.3
	5	4	280	70
Minnow trap	1	4	0	0
	2	4	1	0.25
	3	4	1	0.25
	4	4	0	0
	5	4	0	0
	6	4	1	0.25
	7	4	1	0.25
	8	4	4	1
Trotline	1	4	0	0
	2	4	0	0
	3	4	2	0.5
	4	4	6	1.5
	5	4	6	1.5
	6	4	2	0.5
	7	4	2	0.5
	8	4	2	0.5

Previous Surveys Results

Four fish surveys were conducted over the course of one year between 2009 and 2010. Forty-five estuarine or freshwater fish species were identified throughout the LPRSA (Windward 2010, 2011). Of the total fish caught during the recent surveys, the majority of fish collected (87%) were classified as benthic omnivores or invertivores/omnivores. The remaining fish caught were classified as planktivores (8%), invertivores/piscivores (3%), or piscivores (1%; Figure 2). A complete summary of the fish collected during the 2009 and 2010 fish surveys is provided in Appendix B.

Figure 2. Fish feeding guild abundance from the 2009 and 2010 fish community surveys



Proposed Survey Methods

A variety of sampling methods will be used in various habitat types to target different fish species, including minnow traps, trotlines, cast nets, gillnets, beach seine nets, and possibly trawling. Multiple survey methods may be used in different reaches of the river depending on water depth, riprap/vegetation, and anticipated species present. According to reports of the 2009 and 2010 fish community surveys conducted by Windward however, seining proved to be the leading method by which fish were collected (87% of the total fish caught; Windward 2010), and is therefore expected to be one of the dominant methods used during the 2020 surveys. As seen in Table 1, gillnets and backpack electrofishing are also effective methods that will likely be used in the 2020 fish community survey.

Based on recent conversation with Thomas (Motz) Grothues from Rutgers University, otter and beam trawling is a very effective method in deep river systems such as the Passaic River. Trawling also provides for more accurate calculations of fish density for each trawl sweep in the river. Trawling does require a day of side scan sonar surveys to determine whether obstacles on the river bottom will prevent full sweeps throughout the river.

Table 2. Proposed sampling methods for 2020 fish surveys.

Sampling Equipment	Reach	General Habitat Type
Minnow trap, possibly trot lines	1 – 8	mudflats or shallow area with varied substrate; overhanging or shoreline vegetation present at most locations; bulkhead and riprap often present
Cast net or gill nets	1– 8	mudflats or shallow area with varied substrate; overhanging or shoreline vegetation present at the shoreline at most locations; bulkhead and riprap occasionally present
Gill nets	1-8	mudflats or shallow area with varied substrate; overhanging or shoreline vegetation present at the shoreline at most locations; bulkhead and riprap occasionally present
Seine net	3 – 8	mudflats or shallow area with varied substrate; overhanging or shoreline vegetation present at the shoreline at most locations; bulkhead and riprap occasionally present
Gill nest	1-8	deeper water with riprap or rocky substrate; overhanging or shoreline vegetation present at most locations
Trawling	1-8	Possible method in sections of river with little debris on bottom

Survey Areas

Survey areas will be divided into 8 separate reaches by 2-mile segments as follows:

- Reach 1: River Mile 0-2
- Reach 2: River Mile 2-4
- Reach 3: River Mile 4-6
- Reach 4: River Mile 6-8
- Reach 5: River Mile 8-10
- Reach 6: River Mile 10-12
- Reach 7: River Mile 12-14
- Reach 8: River Mile 14-16

By dividing the survey efforts into separate reaches, the Federal Trustees will be able to directly quantify injury to fish communities following the results of the fish toxicity studies, in which the nature and extent of injury due to dioxin-like compounds to mummichog fish (*Fundulus heteroclitus*) collected from each reach of the Lower Passaic River will be evaluated.

Density and Catch per Unit Effort

During surveys, the number of fish per species, reach, time, and number of attempts will be recorded for a given location for future density and CPUE calculations. Both density and CPUE will be calculated for each Reach (1-8) of the river. CPUE is calculated as the ratio of the number of specimens caught at a given location divided by the number of attempts required to catch those specimens at that location. CPUE will be calculated by sampling method/gear type for each reach of the river, as well as for the entire Lower Passaic River, as a means to gauge the effectiveness of each method.

Reference Areas

In addition to the Lower Passaic River, the Raritan River will be surveyed for comparison as a reference urban, tidal system that transitions from freshwater to estuarine. Due to logistical constraints, community surveys in the Raritan River will likely be conducted in 2021.

Quality Assurance/Quality Control Plan

All field-collected information is recorded in bound field notebooks as well as field forms, shall be signed and dated by the project principal investigator (PI). The PI be also be field team leader to supervise the day-to-day field activities, including revising survey methods, field observations, and field measurements. The PI will be responsible for all field quality assurance procedures and will review all notes for accuracy prior to their submittal at the end of each field day. The PI will work with Kendall Simon of the USFWS to determine appropriate sampling methods in each reach prior the start of the investigation.

Kendall Simon and, as appropriate, Ann Jones of Industrial Economics, Inc., or another member of the USFWS New Jersey Field Office NRDA staff will join the field team to conduct an audit of field team operations. The purpose of these audits will be to evaluate adherence to proposed methods and survey locations, as well as proper documentation of results.

If, during the course of any field audits deficiencies and other non-conforming conditions are identified they shall be documented, and the Federal Trustee shall prescribe corrective action(s). Kendall Simon and the PI shall then communicate prescribed recommendations for corrective actions to team members to ensure they are followed.

Plan for Peer Review

This preliminary investigation plan will be peer reviewed by the DASS Federal Trustees and Cathy Marion (USFWS).

Chapter 4 | Anticipated Effort and Expenses

Three fish surveys will be conducted in 2020 in the Lower Passaic River, as well as a reference urban system such as the Raritan River. One survey in each river will occur in early spring of 2020 to document the arrival of species into the river. A second survey will be conducted during the summer of 2020, followed by a third during the fall of 2020. A total of 13 fish were caught during the 2-week effort conducted by Windward during the winter of 2010. Due to this, the Trustees are not proposing to conduct a winter survey (Windward 2010).

Because the Passaic River is such a highly industrial and complex river system, several survey methods will need to be utilized to document fish community structure and relative abundance. The Federal Trustees propose Thomas (Motz) Grothues of Rutgers University as a potential contractor to conduct the side scan sonar and beam/otter trawl surveys, as well as to serve as a

local resource for future fish surveys. Olaf Jensen will then conduct all other survey methods that will target species not collected through the trawl surveys, such as gillnets, minnow traps, and seine nets. The combined efforts of Thomas (Motz) Grothues and Olaf Jensen will also provide for both the Lower Passaic and the Raritan to be surveyed in 2020.

The Federal Trustees also propose to conduct three fish surveys in the Lower Passaic River after the dredging remedy is completed, as well as in the Raritan River for use as a reference comparison. The budget shown in Table 3 reflects the total costs for both 2020 and all proposed future surveys.

Table 3. Budget for fish surveys.

Personnel	**Hourly Rate**	**Days**	**Hours**		**Amount**
Thomas Grothues, Rutgers					
Surveys	$115	30	240		$27,600
Data Analysis/Report Writing	$115	5	40		$4,600
Field Technician	$95	35	240		$22,800
Equipment and Supplies	**Rate**	**Number**			**Amount**
Rutgers 18' Skiff	$250	30			$7,500
CTD/Sonde Instrument	$25	30			$750
16' Otter Trawl	$1,300	1			$1,300
Batteries, tubs, write-in-the-rain paper, rope, net repair supplies, etc.	$1,300	NA			$1,300
Travel	**Rate**	**Days**	**Miles**		
	$0.58	30	106		$1,844
				Percentage	
				20%	$13,539
Rutgers Overhead				56%	$45,491
				Rutgers Total	$126,724
Personnel	**Hourly Rate**	**Days**	**Hours**		**Amount**
Olaf Jensen					
Surveys	$145	30	240		$34,800
Data Analysis/Report Writing	$145	5	40		$5,800
Field Technician	$40	30	300		$12,000
Equipment and Supplies	**Amount**	**Number**			**Amount**
Boat	$400	30			$12,000
Boat Ramp Fees	$10	30			$300
Docking Fee					$400
NJDEP Sampling Permit Fees	$24	1			$24
Bait (frozen clams or alternative)	$15	6			$90
Minnow Traps	$14	12			$162
Trotlines	$45	3			$135
Gillnets	$125	4			$500
Seine	$500	4			$2,000
				Percentage	
Contingency				20%	$13,642
				Jensen Total	$81,853
				Total 2020 (Passaic + Reference River)	$208,577
				Total 2020 + Post Dredge	$417,154.23

References

Windward (Windward Environmental, L.L.C.). 2010. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Winter 2010 fish community survey. Addendum to the Quality Assurance Project Plan: Fish and decapod crustacean tissue collection for chemical analysis and fish community survey. Addendum No. 1. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Submitted to USEPA on January 22, 2010. Windward Environmental LLC, Seattle, WA.

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Appendix A | Summary of fish collected during 2009 and 2010 Lower Passaic River surveys

Common Name	Scientific Name	Habitat Preference	Reaches Where Collected	Count[a]
Benthic Omnivore				
American eel, small (< 50 cm in length)[b]	*Anguilla rostrata*	freshwater/estuary	1, 2, 3, 4, 5, 6, 7, 8	743
Banded killifish	*Fundulus diaphanus*	freshwater	1, 2, 3, 4, 5, 6	359
Bluegill	*Lepomis macrochirus*	freshwater	3, 4, 5, 6, 7, 8	146
Common carp	*Cyprinus carpio*	freshwater/estuary	3, 4, 5, 6, 7, 8	215
Goby (unspecified)	na	estuary	1, 2	12
Green sunfish	*Lepomis cyanellus*	freshwater	8	2
Mummichog	*Fundulus heteroclitus*	estuary	1, 2, 3, 4, 5, 6, 8	1,696
Pumpkinseed	*Lepomis gibbosus*	freshwater	4, 5, 6, 7, 8	132
Redbreast sunfish	*Lepomis auritus*	freshwater	4, 5, 7, 8	113
Striped killifish	*Fundulus majalis*	freshwater	1, 2, 3, 4, 5, 6, 7	412
Tessellated darter	*Etheostoma olmstedi*	freshwater	4, 5, 6, 7, 8	52
Guild total				**3,882**
Invertivore/Omnivore				
Atlantic croaker	*Micropogonias undulatus*	estuary	3	1
Atlantic silverside	*Menidia menidia*	estuary	1, 2, 3, 4, 5, 6	242
Atlantic tomcod	*Microgadus tomcod*	migratory/estuary	1, 2, 3	8
Bay anchovy	*Anchoa mitchilli*	freshwater/estuary	2	3
Brown bullhead	*Ameiurus nebulosus*	estuary	3, 4, 6, 7, 8	11
Catfish (unspecified)	na	freshwater/estuary	8	1
Channel catfish	*Ictalurus punctatus*	freshwater/estuary	5, 6, 7, 8	17
Hogchoker	*Trinectes maculatus*	freshwater	1, 4	3
Inland silverside	*Menidia beryllina*	freshwater	1, 2, 3, 4, 5, 8	193
Mottled sculpin	*Cottus bairdii*	freshwater	8	3
Northern pipefish	*Syngnathus fuscus*	estuary	1, 4	6
Satinfin shiner	*Cyprinella analostana*	freshwater	8	3
Shiner (unspecified)	na	freshwater	7, 8	34
Silver perch	*Bairdiella chrysoura*	freshwater/estuary	1	1
Silver shiner	*Notropis photogenis*	freshwater	8	62
Spottail shiner	*Notropis hudsonius*	freshwater	3, 4, 5, 6, 7, 8	194
Striped mullet	*Mugil cephalus*	migratory/freshwater	1, 2, 3, 4, 5, 6	78
Sucker (unspecified)	na	freshwater	8	15
Weakfish	*Cynoscion regalis*	estuary	1, 3	4
White perch, small (< 20 cm in length)[c]	*Morone americana*	freshwater/estuary	1, 2, 3, 4, 5, 6, 7, 8	1,273
White sucker	*Catastomus commersoni*	freshwater/estuary	4, 5, 6, 7, 8	41

Common Name	Scientific Name	Habitat Preference	Reaches Where Collected	Count[a]
Winter flounder	*Pseudopleuronectes americanus*	freshwater/estuary	1, 2	3
Guild total				**2,196**
Planktivore				
Atlantic menhaden	*Brevoortia tyrannus*	migratory/estuary	1, 2, 3, 4, 5	284
Gizzard shad	*Dorosoma cepedianum*	freshwater	1, 2, 3, 4, 5, 6, 7, 8	251
Alewife	*Alosa pseudoharengus*	migratory/estuary	1, 2	5
Guild total				**540**
Piscivore/Invertivore				
American eel, large (length ≥ 50 cm)[b]	*Anguilla rostrata*	freshwater/estuary	1, 2, 3, 4, 5, 6, 7	47
Black crappie	*Pomoxis nigromaculatus*	freshwater	4, 6	3
Crevalle jack	*Caranx hippos*	estuary	1, 4	2
Northern searobin	*Prionotus carolinus*	migratory/estuary	1	1
Redfin pickerel	*Esox americanus*	freshwater	7	1
Rock bass	*Ambloplites rupestris*	freshwater/estuary	6, 8	13
Striped bass	*Morone saxatilis*	freshwater/estuary	1, 2, 3, 4, 5, 6, 7, 8	87
Summer flounder	*Paralichthys dentatus*	estuary	1, 2	2
White catfish	*Ameiurus catus*	freshwater/estuary	2, 3, 4, 5, 6, 7, 8	38
White perch, large (length ≥ 20 cm)[c]	*Morone americana*	freshwater/estuary	1, 2, 3, 4, 5, 6, 7, 8	53
Guild total				**247**
Piscivore				
Bluefish	*Pomatomus saltatrix*	estuary	1, 2	37
Largemouth bass	*Micropterus salmoides*	freshwater/estuary	4, 5, 8	21
Longnose gar	*Lepisosteus osseus*	freshwater	5	1
Northern pike	*Esox lucius*	freshwater/estuary	5, 6	2
Smallmouth bass	*Micropterus dolomieu*	freshwater/estuary	4, 5, 6, 7, 8	40
Guild total				**101**
Fish Total				**6,966**

[a] Count refers to the total number of each species caught and has not been normalized to area.

[b] American eel were divided into two size classes (small eel < 50 cm in length and large eel ≥ 50 cm in length) based on the different feeding characteristics of juvenile and adult eel. Of the eel for which length information was available (some eel were weighted in groups or were not whole when collected, and thus could not be measured), 6% were ≥ 50 cm in length.

[c] White perch were divided into two size classes (small perch < 20 cm in length and large perch ≥ 20 cm in length) based on the different feeding characteristics of juvenile and adult white perch. Of the perch for which length information was available (some perch were weighted in groups or were not whole when collected, and thus could not be measured), 4% were ≥ 20 cm in length.

na – not applicable (e.g., species not identified)