

**Duda, Steve**

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**From:** Chase, Brad (FWE) [Brad.Chase@state.ma.us]  
**Sent:** Wednesday, September 20, 2006 8:57 AM  
**To:** Duda, Steve  
**Cc:** Ayer, Matt (FWE)  
**Subject:** RE: rainbow smelt data  
**Attachments:** Jones river catch table-05.xls; Final Report 2004.doc

Steve,

Here are the Jones River catch data for our smelt fyke net project. I recently finished the 2005 audit and we are entering 2006 data now. Let me know if you would like more details. I will have the 2005 report done in about a month and have the summary 2006 data available about the same time. It is important to note that we changed nets in 2005. We used a very small fyke net in 2004. We have used the same net in 2005 and 2006 with good success. I'm sorry about the delay in meeting your request. I should not have been so optimistic about our ability to process data during the summer field season.

Sincerely, Brad.

\*\*\*\*\*

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-----Original Message-----

**From:** Duda, Steve [mailto:Steve.Duda@earthtech.com]  
**Sent:** Friday, August 18, 2006 4:08 PM  
**To:** Chase, Brad (FWE)  
**Cc:** Duda, Steve  
**Subject:** rainbow smelt data

Brad, per our conversation earlier today, I am requesting any recent data that you may have on rainbow smelt in Massachusetts. You mentioned that a report is available for 2004, a data audit has been done for 2005 and a summary table will be available based on the 2006 monitoring.

This information will be used by Earth Tech to support an EIS currently being developed by the NRC and Earth Tech to address the potential impacts of re-licensing Pilgrim Nuclear Power Station. Thank you very much for your assistance.

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10/24/2006

# FINAL REPORT for 2004 SEASON

(FEBRUARY 2006)

## Population Indices of Rainbow Smelt (*Osmerus mordax*) Spawning Runs in Massachusetts.

*Prepared for:* National Marine Fisheries Service (NOAA Fisheries)  
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*NMFS Project Number:* O-2003-NER4

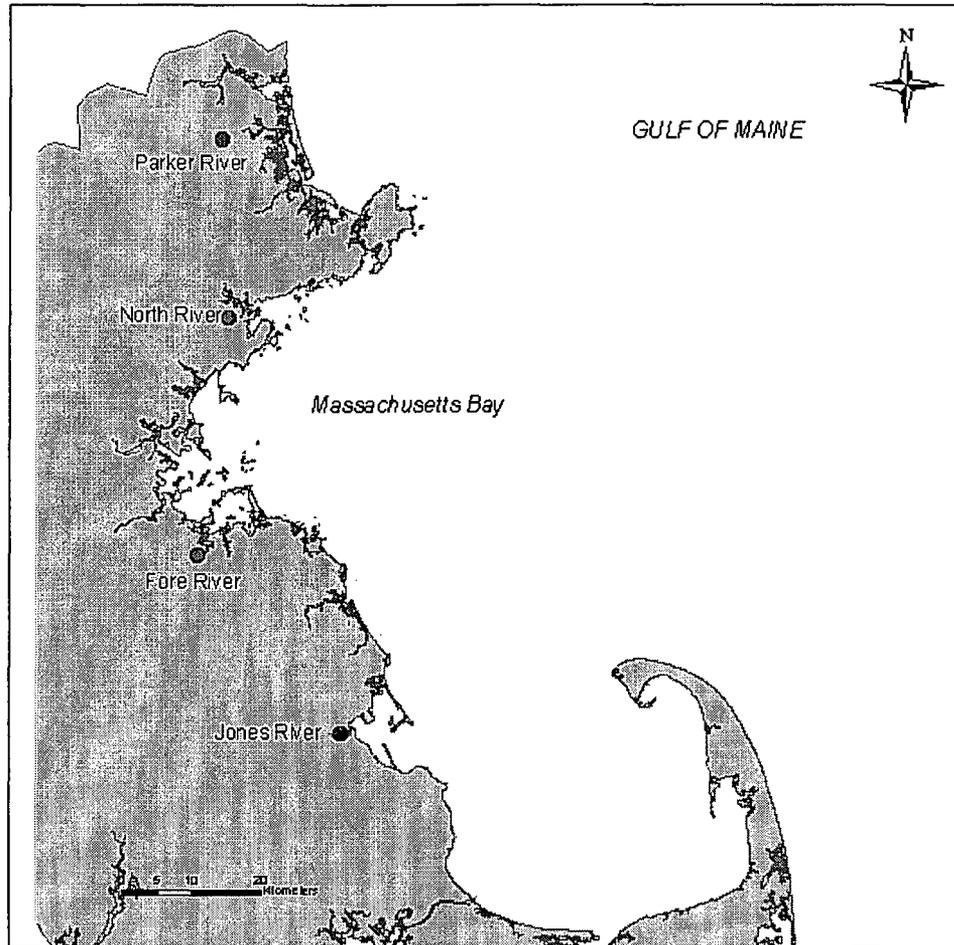
### Project Objective

A grant was received from NOAA Fisheries to conduct a two-year pilot study to develop monitoring protocols for biological and population parameters of rainbow smelt runs in Massachusetts. The monitoring focused on adult smelt during the spring spawning runs to produce estimates of size composition, age composition, sex ratio, survival, total mortality and a catch per unit index of abundance. This pilot effort began in 2004 and will be developed into an annual DMF monitoring project in 2006. This effort may also be useful for assisting the development of monitoring in other regions in New England, and for future sampling related to tagging experiments and restoration efforts using marked hatchery smelt. See "Field Sampling and Data Collection" in Appendix for specific details on sampling methods.

### 2004 Catch Summary

Fyke nets were set twice weekly in the following rivers during the period of March 7th - May 19th: Jones River (Kingston), Fore River (Braintree), North River (Salem), and Parker River (Newbury) (Figure 1). At least 18 successful hauls were made in each river during 2004. Three sampling periods during early April were incomplete due to a rain storm that brought 4-6 inches of rain to the region. Otherwise, the nets fished well as deployed. Smelt were caught in each river except the North River, and large numbers of smelt were only caught in the Fore River (Table 1). A total of 17 species of fish was caught (5 diadromous, 4 estuarine, and 8 freshwater); with mummichog, American eel, and fourspine stickleback following smelt in terms of highest relative abundance (Table 2). All catch and age data have been entered into an Access database and fully audited.

Figure 1. Smelt fyke net sampling stations for smelt fyke nets in the Parker River, Parker River, Fore River and Jones River during 2004.



**Table 1.** Rainbow smelt fyke net catch summary, 2004. Ages for Parker River and Jones River smelt were allocated using age-length proportions from the Fore River sample.

River	Total Catch (No.)	Hauls (No.)	CPUE (smelt/haul)	Length Sample (No.)	Age Sample (No.)	Male (%)	Female (%)	Age-1 (%)	Age-2 (%)	Age-3 (%)
Fore	740	18	41.1	640	295	81.0	18.9	93.5	4.5	2.0
Jones	22	21	1.0	22	0	81.8	18.2	68.2	18.2	13.6
Parker	3	18	0.2	3	0	100.0	0	66.7	33.3	
North	0	18	0							

**Table 2.** Summary of fyke net catches at four sampling stations, 2004 (75 hauls).

Species Name	Scientific Name	Type	Total Catch (No.)	Occurrence (No. of Hauls)
rainbow smelt	<i>Osmerus mordax</i>	Diadromous	765	19
American eel	<i>Anguilla rostrata</i>	Diadromous	134	29
Atlantic tomcod	<i>Microgadus tomcod</i>	Diadromous	14	5
lamprey	<i>Petromyzon marinus</i>	Diadromous	4	4
white perch	<i>Morone americanus</i>	Diadromous	1	1
mummichog	<i>Fundulus heteroclitus</i>	Estuarine	201	18
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	104	29
threespine stickleback	<i>Gasterosteus aculeatus</i>	Estuarine	51	18
winter flounder	<i>Pseudopleuronectes americanus</i>	Estuarine	2	2
yellow perch	<i>Perca flavens</i>	Freshwater	42	8
redfin pickerel	<i>Esox americanus americanus</i>	Freshwater	4	4
golden shiner	<i>Notemigonus crysoleucas</i>	Freshwater	4	4
pumpkinseed	<i>Lepomis gibbosus</i>	Freshwater	4	2
banded sunfish	<i>Enneacanthus obesus</i>	Freshwater	3	3
bluegill	<i>Lepomis macrochirus</i>	Freshwater	2	2
white sucker	<i>Catostomus commersoni</i>	Freshwater	2	1
yellow bullhead	<i>Ameiurus natalis</i>	Freshwater	2	1
<b>Total Fish Catch</b>			<b>1339</b>	

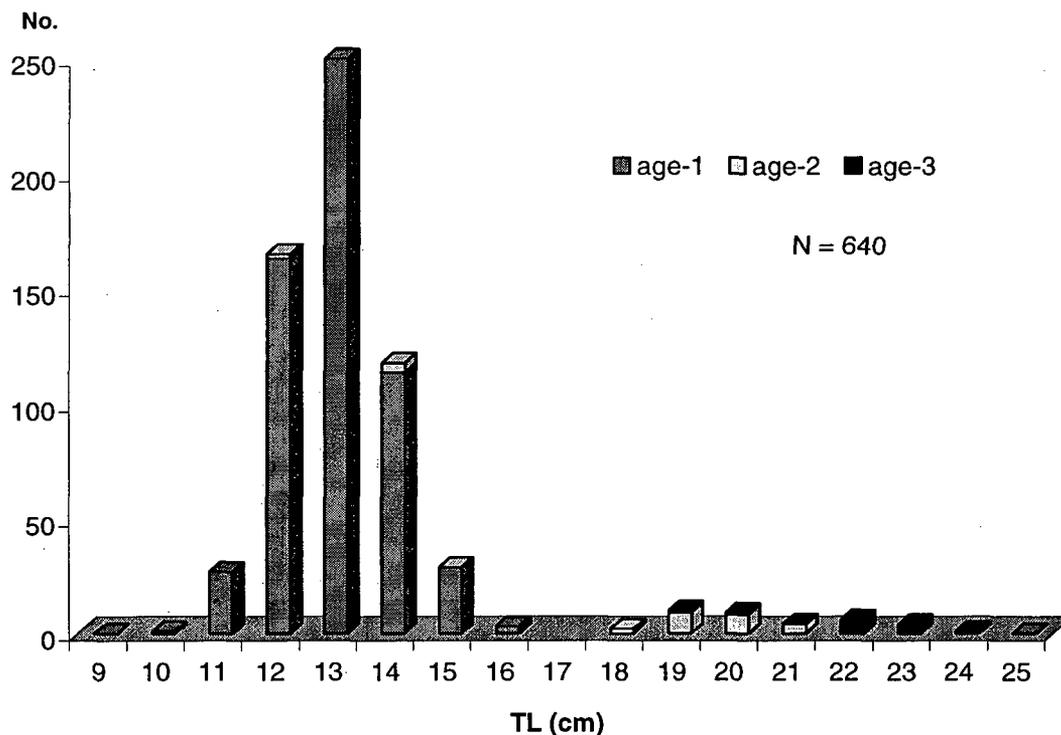
**Fore River Smelt Catch.** The Fore River was the only station that caught enough smelt to evaluate size and age composition. Smelt were caught in all but one fyke net deployment from March 7<sup>th</sup> through May 10<sup>th</sup>. A total of 740 smelt were caught in 13 hauls. Total length samples were recorded from 12 hauls (N = 640) and age samples were collected from only 4 hauls (N = 295). Peak catches occurred on April 12<sup>th</sup> when 569 smelt were captured. This large catch dominated the length and age composition of smelt catches in the Fore River. The large number of smelt overwhelmed the capacity of the fyke net, resulting in 358 dead smelt in the catch.

**Smelt Population Data.** A total of 295 smelt from the Fore River were aged using the methods of McKenzie (1958), and the age sub-sample proportions were applied to the 640 smelt with measured lengths (Appendix, Table 8). Age-1 smelt dominated the age composition (93.5%; Figure 2), and over 75% of the age-1 smelt were mature males. No age-4 smelt were found in this sample and only 2% were age-3. This age-length key is the first generated for a Massachusetts' smelt run in nearly 25 years. These results are different from previous studies that aged smelt in Massachusetts (Murawski and Cole 1978; and Lawton et al. 1990) and New Hampshire (Grout and Smith 1994) that found that age-2 smelt comprised a majority of the spawning run and had higher percentages of age-3 and age-4. The sex ratio for the 640 measured smelt was 4.3:1, male to female.

The dominance of age-1 smelt in the age composition may be biased by the reliance of the sample on smelt from the April 12<sup>th</sup> catch (476 of 640 measured smelt and 208 of 295 aged smelt). Secondly, the influence of males spawning multiple nights on catch rates and composition was not assessed. For these reasons, these data should be considered with caution. Length samples were distributed over 12 hauls and had age-1 smelt in most samples. Despite the potential bias, the high percentage of age-1 smelt appeared to be characteristic of this annual run

and may indicate the presence of a relatively large cohort. Sampling in 2005 and 2006 may support the possibility that a strong cohort of age-1 smelt was present in 2004. All scale samples were read by at least two readers, with high agreement among readers (>90%; see ageing QA in Appendix). The age and length data were processed also by sex and by 0.5 cm intervals but there were too many missing length intervals to produce an age-length key for both these categories.

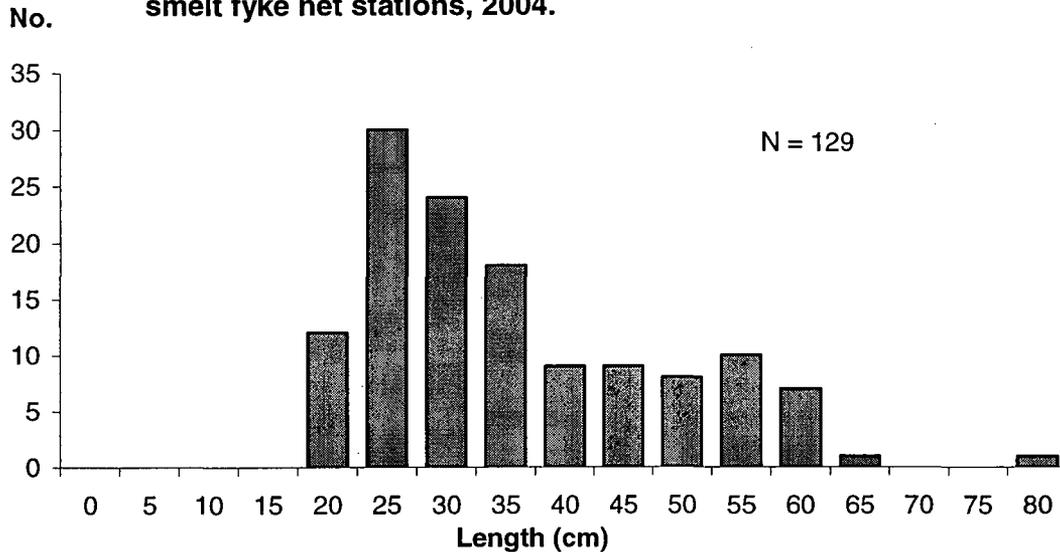
**Figure 2. Length and age frequency of smelt samples from the Fore River fyke net catch, 2004.**



**Other Diadromous Fish Species.** The fyke net catches provided useful data documenting the presence of four additional diadromous species (sea lamprey, American eel, Atlantic tomcod and white perch) and providing catch and size data for American eel and Atlantic tomcod. There is presently concern over the population status for these two species in Massachusetts, and population data are limited for eel and absent for tomcod. Eels were uniformly present in each river. They were caught in 6-8 hauls, during late-March through May in each river with a wide range of juvenile and adult sizes (Figure 3). Tomcod were only caught in the Fore River during the first month of sampling. Fourteen tomcod were caught with a total length range of 12-19 cm.

**Jones River.** The Jones River was the only river successfully sampled for each targeted fyke net haul (N = 21). The catches in the Jones had relatively low diversity and abundance (Table 3). It was the only location where the anadromous white perch was caught in 2004 and had the highest catch of a freshwater species, as frequent catches of YOY yellow perch occurred late in the season. The location used for setting the fyke was suitable and will be used again in 2005.

**Figure 3. American eel length frequency for all catches at four smelt fyke net stations, 2004.**



**Fore River.** In addition to having large smelt catches, the Fore River also had the only tomcod catches and second highest eel catch (Table 4). Fish diversity (10 species) was tied for the highest and fish relative abundance was highest among the four stations. The net location under Shaw Street bridge was selected to avoid detection, however, the bridge constriction caused turbulent flows and at times was treacherous to approach. The net location will be adjusted downstream about 50 m for the 2005 season.

**North River.** No smelt were caught in the North River and American eel was the only diadromous fish species caught (Table 5). The North River tied the Jones River for the lowest fish diversity (6 species) and had the second highest relative fish abundance due to large catches of mummichogs. The low diversity and poor diadromous fish catches were not unexpected in this highly urbanized river system with the most degraded channel habitat among sample locations. Smelt were present in the North River during 2004 as evident by observations of very low densities of smelt eggs at spawning riffles upstream of the fyke net.

**Parker River.** The Parker River was tied with the Fore River for highest fish diversity (10 species) (Table 6). The diversity was enhanced by the presence of five freshwater species that were likely flushed over the dam located less than 0.5 km upstream of the fyke net. This location had the highest eel catch and the only catches of anadromous sea lamprey. Only three smelt were caught during one haul in 2004. Smelt egg deposition was monitored upstream of the fyke net location finding light egg densities with a peak in late-March and a shorter than typical spawning season. It is likely that this net was undersized for the relatively wide intertidal channel below the dam where it was set. The net location will be shifted about 50 m downstream to where the marsh channel narrows.

**Table 3.** Fyke net catch in the Jones River, Kingston, 2004 (21 hauls).

Species Name	Scientific Name	Type	Total Catch (No.)	Occurrence (No. of Hauls)
rainbow smelt	<i>Osmerus mordax</i>	Diadromous	22	6
American eel	<i>Anguilla rostrata</i>	Diadromous	17	8
white perch	<i>Morone americanus</i>	Diadromous	1	1
mummichog	<i>Fundulus heteroclitus</i>	Estuarine	3	2
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	2	2
yellow perch	<i>Perca flavens</i>	Freshwater	42	8
sand shrimp	<i>Crangon septemspinosa</i>	Arthropod	1	1
green crab	<i>Carcinus maenas</i>	Arthropod	11	5
<b>Total Fish Catch</b>			<b>87</b>	

**Table 4.** Fyke net catch in the Fore River, Braintree, 2004 (18 hauls).

Species Name	Scientific Name	Type	Total Catch (No.)	Frequency of Occurrence (No. of Hauls)
rainbow smelt	<i>Osmerus mordax</i>	Diadromous	740	12
American eel	<i>Anguilla rostrata</i>	Diadromous	38	7
Atlantic tomcod	<i>Microgadus tomcod</i>	Diadromous	14	5
mummichog	<i>Fundulus heteroclitus</i>	Estuarine	1	1
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	12	6
threespine stickleback	<i>Gasterosteus aculeatus</i>	Estuarine	4	4
winter flounder	<i>Pseudopleuronectes americanus</i>	Estuarine	2	2
bluegill	<i>Lepomis macrochirus</i>	Freshwater	2	2
golden shiner	<i>Notemigonus crysoleucas</i>	Freshwater	1	1
redfin pickerel	<i>Esox americanus americanus</i>	Freshwater	2	2
sand shrimp	<i>Crangon septemspinosa</i>	Arthropod	1	1
<b>Total Fish Catch</b>			<b>816</b>	

**Table 5.** Fyke net catch in the North River, Salem, 2004 (18 hauls).

Species Name	Scientific Name	Type	Total Catch (No.)	Occurrence (No. of Hauls)
American eel	<i>Anguilla rostrata</i>	Diadromous	33	8
threespine stickleback	<i>Gasterosteus aculeatus</i>	Estuarine	25	8
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	5	5
mummichog	<i>Fundulus heteroclitus</i>	Estuarine	197	16
redfin pickerel	<i>Esox americanus americanus</i>	Freshwater	2	2
golden shiner	<i>Notemigonus crysoleucas</i>	Freshwater	2	2
leopard frog	<i>Rana sp.</i>	Amphibian	1	1
<b>Total Fish Catch</b>			<b>264</b>	

**Table 6.** Fyke net catch in the Parker River, Newbury, 2004 (18 hauls).

Species Name	Scientific Name	Type	Total Catch (No.)	Frequency of Occurrence (No. of Hauls)
rainbow smelt	<i>Osmerus mordax</i>	Diadromous	3	1
American eel	<i>Anguilla rostrata</i>	Diadromous	46	6
lamprey	<i>Petromyzon marinus</i>	Diadromous	4	4
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	85	16
threespine stickleback	<i>Gasterosteus aculeatus</i>	Estuarine	22	6
white sucker	<i>Catostomus commersoni</i>	Freshwater	2	1
pumpkinseed	<i>Lepomis gibbosus</i>	Freshwater	4	2
banded sunfish	<i>Enneacanthus obesus</i>	Freshwater	3	3
golden shiner	<i>Notemigonus crysoleucas</i>	Freshwater	1	1
yellow bullhead	<i>Ameiurus natalis</i>	Freshwater	2	1
green crab	<i>Carcinus maenas</i>	Arthropod	1	1
crayfish	<i>Cambarus sp.</i>	Arthropod	1	1
tadpole	<i>Amphibia</i>	Amphibian	1	1
<b>Total Fish Catch</b>			<b>172</b>	

### Water Chemistry Measurements

Water chemistry was measured for the parameters listed in Table 7 using a calibrated YSI 6820 at the time of each haul. For the parameters measured, water quality conditions were adequate to support aquatic, with the exception of violations of Massachusetts Surface Water Quality Criteria for pH (<6.5). The Jones River was particularly acidic with a season mean of 6.3 pH and few measurements above the water quality criteria. The Fore River and Parker River had few violations with base flows above 6.5 and the North River had no violations. Dissolved oxygen was at or near saturation for all measurements. The rain event of March 31<sup>st</sup> and April 1<sup>st</sup> caused the loss of at least two water chemistry measurements at each station. These measurements would have shown sharp increases in turbidity and discharge and decreases in pH. A YSI 6920 was deployed in the Parker River to record water chemistry every hour in 2004. These data captured the rain event, although require additional processing and are not available at the time of this report.

**Table 7.** Average water chemistry measurements at four smelt fyke net locations in 2004. Water chemistry was measured with a YSI 6820 during each haul date (N = 19).

River	Time	Water Temp. (C°)	Sp. Cond. (mS/cm)	D.O. (% Sat.)	D.O. (mg/L)	pH	Turbidity (NTU)	Discharge (cfs)
Jones	10:54	9.62	0.246	103.26	11.69	6.27	4.54	70.64
Fore	10:33	9.77	0.567	100.26	11.52	6.63	4.61	
North	11:31	10.19	0.849	103.83	11.73	6.85	5.16	
Parker	13:11	9.66	0.255	98.37	11.40	6.61	3.04	103.68

## Project Costs in 2004.

Final project costs will be summarized after the 2005 season. The expenses below are estimates for the 2004 season. The Division of Marine Fisheries in-kind contributions will also be summarized after the 2005 season and are expected to exceed grant expenses (ex. 2004 PI hours ~ 450 hours; water chemistry instrumentation expenses ~\$2,500; field and lab. supplies ~\$500; and gas for vehicle travel ~\$700).

Technician (508 hours)	\$6604
Indirect (28.56%) and Medicare (\$200)	\$2086
Fyke Nets	\$1280
Field Supplies	\$639
Laboratory Supplies	\$695
<b>Total</b>	<b>\$11,304</b>

## Discussion and Outlook for 2005 Season

The small fyke net used (0.6 m hoops with 1 m wings) fished fairly well at the four locations. Adjustments will be necessary for the 2005 season to meet project objectives. A small net was selected to avoid catching too many smelt or bycatch. The net was clearly too small for the wide channels in the Parker and Jones rivers. The net will be increased in hoop and wing size by approximately 25-30%. And the cod-end size will be increased in order to reduce mortality during large catches. The net was set facing upstream in 2004 in order to increase stability by facing stream flow. This configuration was stable but caused a physical strain on the nets as debris gathered in the net. Secondly, there is concern over the potential for biased sampling due to male smelt remaining at upstream spawning habitat during the day. Thirdly, the upstream facing net caught some smelt with wounds that were probably inflicted by upstream predators. With these concerns in mind, the nets will be set facing downstream in 2005. Several trials were conducted in May with nets set facing in both directions in the Jones River. The downstream net remained stable with a properly set anchor and had similar catches as the upstream set net. It is expected that the changes to the size and configuration of the net will be suitable for these rivers without need for future changes.

The 2004 smelt season by qualitative comparisons to past seasons had relatively poor runs in the rivers sampled. The Jones River and Parker River had low fyke net catches and relatively poor egg deposition observed at upstream spawning habitat. The Fore River had a typical season in terms of the timing of the run and the April peak. Observations made while fyke net sampling and at other runs in the region allow the ranking of the Fore River as the largest run on the Gulf of Maine coast of Massachusetts in 2004, however, in a relative comparison to years with large smelt runs, the egg deposition observed was only moderate and with few adult smelt seen at upstream habitat during the daytime. The weather in 2004 was unusual by virtue of the April 1<sup>st</sup> rain event alone. This two-day rain storm brought 4-6 inches of rain to these watersheds and sharply elevated river flow for over three weeks during the peak spawning season. The Parker River discharge increased from 33 cfs the day before the storm to 499 cfs the day after. The scouring effect likely removed any eggs deposited prior to the rain and greatly enhanced the substrate quality after base flows were restored. The North River substrate was highly degraded from sediment, debris and periphyton prior to the rain and became remarkably clean gravel and cobble after the rain past. Within a month, the North River substrate was well on the way to return to the former degraded state.

In addition to increasing the size of the fyke net and changing the orientation to face downstream, the frequency of hauls will be increased in 2005. There is some concern that two hauls per week may be too infrequent to characterize the spawning run. The weekly sampling frequency will be increased to three hauls, resulting in 33 targeted hauls per river in 2005. We will also add two sampling stations in 2005: the Crane River in Danvers as a site to evaluate smelt stocking efforts, and the Saugus River, Saugus, as a population index station. Consideration will be given to tuning the sampling protocols to reduce potential biases in age and sex composition.

#### Literature Cited

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- McKenzie, R.A. 1958. Age and growth of smelt, *Osmerus mordax* (Mitchill), of the Miramichi River, New Brunswick. Journ. Fish. Res. Bd. of Canada, 15(6): 1313-1327.
- Murawski, S. A. and Cole, C. F. 1978. Population dynamics of anadromous rainbow smelt *Osmerus mordax*, in a Massachusetts river system. Transactions of the American Fisheries Society, 107: 535-542.

Population Indices of Rainbow Smelt (*Osmerus mordax*) Spawning Runs in  
Massachusetts.

**Field Sampling and Data Collection (March 2004)**

**Sampling Period.** March 8th - May 15th.

**Fyke Net.** Five hoops (0.6 m or 2 ft. diameter) over a length of 2.5 m with two throats to contain fish. One meter wings are attached on both sides. All meshes are 0.64 cm (1/4 in.). Wing poles will be set 1.8 m apart, although this can be adjusted based on water velocity.

**Net Deployment.** The fyke nets will be set overnight and retrieved early the next morning. For each river, a mid-channel location will be selected and used for each deployment. Sample dates will not be randomly selected because of the complexity of coordinating traffic, tide and other tasks. Both the setting and hauling of nets must be done at lower tides; therefore these criteria will be most important for scheduling deployments. Two overnight sets will be made each week (10 weeks, 20 sets)

**Sampling Stations.** Jones River (Kingston), Fore River (Braintree), North River (Salem), and Parker River (Newbury). The sampling stations are located at the lower end of spawning habitat where tidal influence is present.

**Catch Processing.** Empty the net cod-end into buckets. Separate a random sample of smelt (up to 50) in a bucket for age/sex subsample. Measure (TL, mm), sex, and release the remaining smelt up to 100 individuals. Count and release the remaining smelt. Measure and release all other species. Measure no more than 30 mummichogs or sticklebacks.

**Field Data Recording.** Record the time the nets soaked (nearest 0.25 hour), tide stage, moon stage, and water chemistry from YSI 6820 (temp., pH, conductivity, D.O., and turbidity)

**Age/Sex subsample.** The smelt sampled for scale collection and sex should be proportional to the number of smelt in each length class. This can be achieved by randomly mixing a subsample from the collection bucket. No scales will be collected when less than 20 smelt are caught and up to 50 smelt will be aged per set. An exception will be made for very large catches (>200 fish). In this case, a fixed stratified subsample of 10 fish per cm per gender will be selected. An age-length key will be derived for each set.

**Laboratory Processing.** Following net collections, the smelt will be processed that day in Gloucester. The following data will be collected: sex, maturity, total length, fork length (2004 only), weight (2004 only), and scales. Females caught in March will be frozen for fecundity analysis, and a subsample will be frozen each month for future genetic analysis.

**Table 8.** Rainbow smelt age and length composition for Fore River fyke net catches, 2004. No adjustments were made for the size classes where age overlap was likely but not observed.

TL (cm)	TL (mm)	Length Sample (No.)	Age Subsample (No.)	AGE SUBSAMPLE						AGE COMPOSITION BY LENGTH		
				Age-1 (No.)	Age-2 (No.)	Age-3 (No.)	Age-1 (%)	Age-2 (%)	Age-3 (%)	Age-1 (No.)	Age-2 (No.)	Age-3 (No.)
10	100-109	1	1	1			1	0	0	1		
11	110-119	27	18	18			1	0	0	27		
12	120-129	165	73	72	1		0.9863	0.0137	0	163	2	
13	130-139	261	108	108	0		1	0	0	261		
14	140-149	118	60	58	2		0.9667	0.0333	0	114	4	
15	150-159	29	10	10	0		1	0	0	29		
16	160-169	3	1	1	0		1	0	0	3		
17	170-179	0	0									
18	180-189	2	2	0	2		0	1	0		2	
19	190-199	10	7	0	6	1	0	0.8571	0.1429		9	1
20	200-209	9	7	0	6	1	0	0.8571	0.1429		8	1
21	210-219	4	2	0	2	0	0	1	0		4	
22	220-229	6	3	0	0	3	0	0	1			6
23	230-239	4	3	0	0	3	0	0	1			4
24	240-249	1	0									1
<b>Sum</b>		640	295	268	19	8				598	29	13

APPENDIX --- Quality Assurance for smelt ageing in 2004

A total of 295 smelt was aged by reading annuli on scales in 2004. These samples were collected from the Fore River station on only four dates (Table 9). Scales were mounted on microscope slides and read using the “shiny-line” criteria described by McKenzie (1958). Blind reading of mounted scales was conducted by two technicians (KT and KB) for over 90% of the samples. All age-1 smelt <145 mm TL with readers agreement were accepted without further review. A third reader aged all samples that were age-2 or higher, age-1 over 145 mm TL, and those that did not have agreement between the primary readers. The third reader acted as the quality assurance officer (BC) and made the final decision over disputed ages and had access to fish length data. All scale samples were read by at least two readers. All smelt age data were entered to an Access database by KT and a complete audit was made during November 2005 by the QA officer.

Ageing precision was acceptable. The primary readers KT and KB had 90% agreement. Of the 126 scale samples checked by the QA reader, KT had 95% agreement ageing scales read by the QA reader (6 errors). Reader KB had 89% agreement ageing the 126 scales read by the QA reader (14 errors). All remaining samples were smelt <145 mm, which are likely to be age-1 and the primary readers had 100% agreement.. Assuming all remaining age-1 smelt were accurately aged, the overall precision was very good: KT had 98% agreement with final ages accepted by the QA reader (6 errors out of 262 samples), and KB had 95% agreement with the final ages accepted by the QA reader (14 errors out of 270 samples). Despite the high ageing precision, the QA reader found poor scale radii measurements by both primary readers. Reader KB was inconsistent with radii measurements. Reader KT consistently measured higher than actual radii (+6 mm for age-1). Therefore, BC radii measurements were used when available (all except FR-11-04 <145 mm). For the remaining radii, KT data were reduced by 6 mm and used.

The high precision was partially influenced by the presence of only three year classes, and may have been enhanced by the dominance of easily read age-1 smelt in the sample (91%). The total sample is heavily weighted to the April 13<sup>th</sup> sample when 569 smelt were caught with very high net mortality (>60%). The sampling protocol capped age samples at 50 per haul, however greater numbers of scale samples were collected on the 13<sup>th</sup> because of the high mortality among samples and the low numbers of samples collected to date. Ninety percent of the April 13<sup>th</sup> smelt were age-1; possibly biasing the age-key towards a higher percentage of age-1 smelt.

**Table 9.** Summary of smelt scale sampling and ageing for fyke net sampling project in 2004. Most scale samples were read by readers KT and KB (90% agreement). Reader BC read all scales except for sample FR-11-04 in which only disagreements, age-1 smelt >145 mm, and smelt older than age-1 were read. The agreement values shown compare the first two readers with the quality assurance reader.

Date	Sample	Smelt (No.)	READERS				KT (1) Errors (No.)	KT (1) Agreement (%)	KB (2) Errors (No.)	KB (2) Agreement (%)
			KT (1) (No.)	KB (2) (No.)	BC (QA) (No.)					
March 23rd	FR-05-04	5		5	5	0	100	0	100	
March 30th	FR-07-04	40	40	40	40	2	95	4	90	
April 11th	FR-11-04	208	180	183	39	4	90	7	82	
April 30th	FR-16-04	42	42	42	42	0	100	3	93	
<b>Total</b>		295	262	270	126	6	95	14	89	

MASSACHUSETTS DIVISION OF MARINE FISHERIES

**Table xx.** Fyke net catch in the Jones River, Kingston, 2005 (32 hauls).

Species Name	Scientific Name	Type	Total Catch (No.)	Occurrence (No. of Hauls)
rainbow smelt	<i>Osmerus mordax</i>	Diadromous	489	23
American eel	<i>Anguilla rostrata</i>	Diadromous	12	9
white perch	<i>Morone americanus</i>	Diadromous	5	5
alewife	<i>Alosa pseudoharengus</i>	Diadromous	2	2
blueback herring	<i>Alosa aestivalis</i>	Diadromous	1	1
tomcod	<i>Microgadus tomcod</i>	Diadromous	2	2
mummichog	<i>Fundulus heteroclitus</i>	Estuarine	27	9
fourspine stickleback	<i>Apeltes quadracus</i>	Estuarine	31	16
threespine stickleback	<i>Gasterosteus aculeatus</i>	Estuarine	5	5
Atlantic herring	<i>Clupea harengus</i>	Estuarine	3	1
Atlantic silverside	<i>Mendia menidia</i>	Estuarine	2	2
bluegill	<i>Lepomis macrochirus</i>	Freshwater	39	8
yellow perch	<i>Perca flavens</i>	Freshwater	31	10
pumpkinseed	<i>Lepomis gibbosus</i>	Freshwater	23	4
green crab	<i>Carcinus maenas</i>	Arthropod	10	5
sand shrimp	<i>Crangon septemspinosa</i>	Arthropod	2	1
tadpole	<i>Amphibia</i>	Amphibian	2	2
<b>Total Fish Catch</b>			<b>672</b>	

Checked 9/06

Note: targeted 33 hauls and missed one haul during March 30th rain event.