



**REPORT TO THE REGIONAL WATER SUPPLY COMMISSION MEETING
OF WEDNESDAY, APRIL 4, 2012 AND
THE REGIONAL PARKS COMMITTEE MEETING OF APRIL 18, 2012**

SUBJECT **UPDATE ON BULLFROG CONTROL PROGRAM IN THE WESTERN COMMUNITIES
CONTROL CORRIDOR**

ISSUE

Results of the Bullfrog control program in the Western Communities Control Corridor in 2011, and plans for the program in 2012 are presented for the information of the Commission and the Committee.

BACKGROUND

The Bullfrog (*Rana catesbiana*), an invasive non-native species, is expanding its range on southeastern Vancouver Island. This large frog is a prolific breeder and voracious predator that rapidly colonizes wetlands and waterbodies. The Bullfrog is associated with declines in native amphibians, including species at risk, and undesirable alterations to aquatic foodwebs.

Consultations with public health experts in 2005, and a review of the available literature in 2009, produced no documented evidence that Bullfrogs pose a threat to the quality of water in drinking water supply reservoirs. However, both recommended a precautionary approach because of gaps in the current knowledge on the potential effects of Bullfrogs on drinking water quality and that Bullfrogs be prevented from colonizing the Greater Victoria Water Supply Area (GVWSA), if possible.

Since 2006, the Regional Water Supply Commission and the Regional Parks Committee have each provided \$20,000 annually for a program to control Bullfrogs within a land corridor in the Western Communities (Attachment 1). The purpose of the program is to prevent the species from migrating west and colonizing the GVWSA and Sooke Hills Wilderness Regional Park Reserve (SHWRPR). Humpback Reservoir in SHWRPR is located at the westernmost edge of the control corridor.

Control Methods

A two-person crew searches a wetland or waterbody at night in an inflatable raft using powerful spotlights, and a modified fish electroshocker is used to stun juvenile and adult frogs so they can be captured. Typically the crew can only cover one small wetland or waterbody per night. Control activities occur from spring to early fall and focus on different frog developmental stages in different seasons. There is no effective capture method for eggs or tadpoles.

Program Evolution

While the overall purpose of the program continues to be preventing Bullfrogs from migrating west and colonizing the GVWSA and SHWRPR, the objectives have evolved since the program began. The original objective was eradication, i.e. all Bullfrogs eliminated from the corridor. This is no longer considered feasible within the current program, given the difficulties detecting and capturing frogs from heavily vegetated shorelines and wetlands, challenges identifying and accessing all water bodies on private lands, and the continual movements of Bullfrogs into the corridor from established populations to the east.

The current objectives are to remove frogs that migrate into the corridor from established populations to the east, prevent breeding within the corridor and prevent the dispersal of juveniles that develop should breeding occur.

In 2010, the consultant hired for the project (Mr. S. Orchard) reduced the number of control days in the corridor and increased time spent on Bullfrog control in other parts of Greater Victoria (Figure 1 in Attachment 2). Given the importance to Integrated Water Services and Regional Parks of maintaining the corridor, the CRD grant for 2011 was made conditional on all CRD funds being spent exclusively within the control corridor.

Mr. Orchard's perspective on the evolution of the program is provided in his 2011 report to the CRD (Attachment 3).

Program Activities and Accomplishments

Due to difficulties with adapting and testing equipment and control techniques in 2006, Bullfrog removal within the control corridor did not effectively begin until 2007. Between 2007 and 2011 just over 14,000 Bullfrogs have been removed from the control corridor (Figure 2 in Attachment 2).

In 2011, the number of Bullfrogs removed from the corridor more than doubled from the previous year. This was largely due to breeding that occurred in Glen Lake in a previous year and consequent captures of newly metamorphosed juveniles in 2011. An increase in crew days in 2011 likely also contributed to the increase in the number of Bullfrogs removed.

In 2011, the number of Bullfrogs removed from Humpback Reservoir also increased substantially. This increase as well, as the increase in nearby Irwin Ponds may have resulted from Bullfrogs being displaced by land clearing associated with residential development on a nearby private property within the corridor.

Mr. Orchard's perspective on activities and accomplishments in 2011 is provided in Attachment 3.

Monitoring by Integrated Water Services Staff

Since the Bullfrog control program began, Integrated Water Services staff have been monitoring water bodies within the GVWSA and SHWRPR to the west of the control corridor to determine if Bullfrogs had been able to pass through the corridor or invade from other directions. Until 2011, no Bullfrogs were detected within the GVWSA or SHWRPR outside of the control corridor. In 2011, one juvenile Bullfrog was detected and removed from a small wetland just inside the boundary of the GVWSA.

Integrated Water Services staff also monitored water bodies within the control corridor and, thereby improved the likelihood of frog detection, and notified Mr. Orchard of all Bullfrog sightings for subsequent capture.

Plans for 2012

In 2012, the CRD grant to the Bullfrog program will again be conditional on all of the funds being spent in the Western Communities Control Corridor. The objectives will continue to be to remove immigrants and prevent breeding and the dispersal of juveniles to new areas. Integrated Water Services staff will continue to monitor wetlands and waterbodies within and adjacent to the GVWSA and SHWRPR to complement Mr. Orchard's efforts and increase the likelihood of detection in these areas.

After 2012 results have been received and compiled, staff will evaluate the Bullfrog control program in relation to 2013 Integrated Water Services and Regional Parks budgets. Consideration will be given to discontinuing, maintaining, or increasing the program, and recommendations will be prepared for the Water Supply Commission and the Regional Parks Committee.

ALTERNATIVES

Not applicable to this report.

IMPLICATIONS

Social/Public

Members of the public have phoned Regional Parks staff on a number of occasions expressing concern about Bullfrogs. Residents also facilitate Bullfrogs range expansion by moving frogs to waterbodies and wetlands where they are not currently established.

Environmental

This project addresses a threat to environmental values by preventing Bullfrog invasion into the GVWSA and SHWRPR, and other lands including regional parklands to the west. This is consistent with the priority of protection of the natural environment in the 2009-2011 CRD Corporate Strategic Plan. It supports the desired outcome of “effective stewardship of regional parklands and protected areas” under the Environmental Protection Strategic Priority of the CRD Strategic Plan 2009-2011 and also supports the management goal of “protecting the natural environment” in the draft Regional Parks Strategic Plan 2012-2021.

Economic/Financial

Bullfrog control in the designated corridor is much more cost effective than trying to manage Bullfrogs over a much wider area. If CRD funding for Bullfrog removal in the control corridor is ended, Bullfrogs will certainly successfully invade and establish within the GVWSA and SHWRPR.

A \$20,000 grant to fund Bullfrog management in the control corridor is currently included as a single supplementary item in both the Regional Water Supply Commission and Regional Parks budgets for 2012. If it is recommended that funding be maintained or increased in 2013, the effectiveness of the program should continue to be evaluated on an annual basis.

Intergovernmental/Regional

Mr. Orchard received \$10,000 from the City of Langford for Bullfrog control in the Western Communities corridor in 2011. He also received funding from the District of Metchosin and from a number of private landowners for control at sites outside the corridor.

The BC Ministry of Environment endorses efforts to contain the range of the Bullfrog, but has not provided financial support to the CRD for Bullfrog management, despite requests from the CRD Board. The province funded a non-governmental organization in 2009 and 2010 for public education about the dangers of facilitating the spread of Bullfrogs.

Mr. Orchard has applied twice to Environment Canada for funding for Bullfrog control but has not been successful.

Interdepartmental Involvement

Integrated Water Services and Regional Parks collaborate on the Bullfrog program in the control corridor. Each department contributes \$20,000, conditional upon the contribution of the other. Environmental Sustainability allocated approximately \$1,200 to Mr. Orchard in 2011 to remove Bullfrogs from water bodies at the Hartland Landfill. This initiative is separate from the control corridor program.

CONCLUSIONS

Bullfrogs are a recognized threat to native amphibians and alter the ecology of water bodies and wetlands. While there is no evidence that Bullfrogs pose a threat to the quality of water in drinking water supply reservoirs, public health experts have recommended that, as a precaution, Bullfrogs be prevented from colonizing the Greater Victoria Water Supply Area.

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The Bullfrog control program in the Western Communities control corridor has prevented the species from successfully colonizing the Greater Victoria Water Supply Area and Sooke Hills Wilderness Regional Park. A defined control corridor remains a cost-effective and efficient strategy for preventing the spread of Bullfrogs provided that sufficient resources are allocated to minimize breeding and prevent the dispersal of newly metamorphosed juveniles. Bullfrog populations within the control corridor can be controlled with the current level of resources allocated to the program, but there is a chance that breeding can still occur. In-migration also continues from colonized areas to the east.

Given these factors, an ongoing financial commitment would be required for the foreseeable future, if the program is to continue. To facilitate annual reviews of the program, this funding should remain a single supplementary item in the departmental budgets. A staff report on the 2012 Bullfrog control program and consideration of funding alternatives for 2013 will be brought to the November 2012 meetings of the Commission and Committee.

RECOMMENDATION

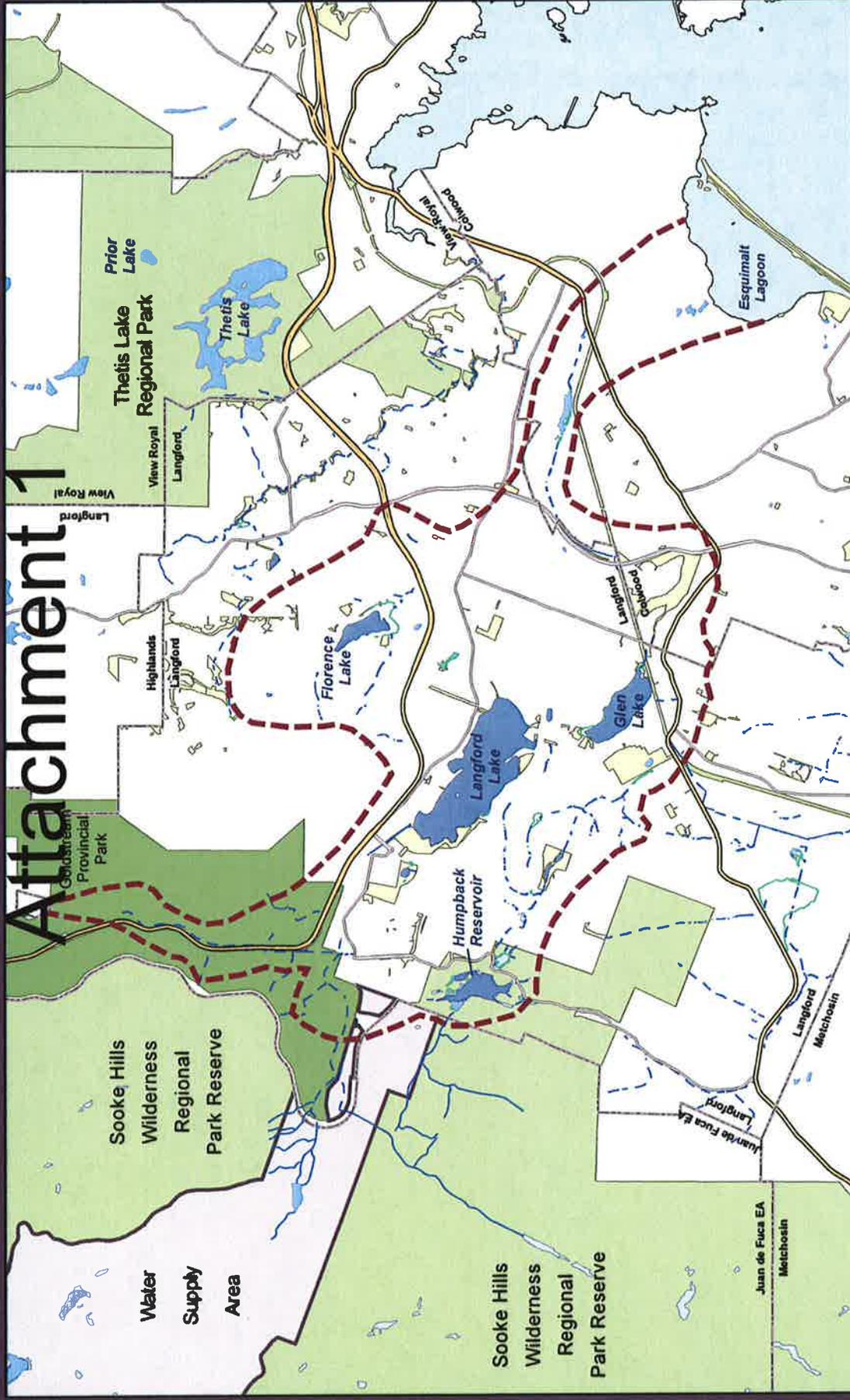
That the Regional Water Supply Commission and the Regional Parks Committee receive the staff report for information.

J.A. (Jack) Hull, MBA, P.Eng.
General Manager, Integrated Water Services

Lloyd Rushton
General Manager, Parks and Community Services

Attachments: 3

Attachment 1



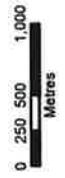
Map 2
Control Corridor for Pilot Project to Eradicate American Bullfrogs
Integrated Water Services
Management of American Bullfrogs



Important This map is for general information purposes only. The Capital Regional District (CRD) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. This map is not for navigation. The CRD will not be liable for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.



NAD83 UTM Zone 10



<ul style="list-style-type: none"> Municipal Boundary Roads Wetland/Marsh (Detailed) Stream Stream-Indefinite Course Bullfrogs Detected Bullfrog Control Corridor 	<ul style="list-style-type: none"> Wetland Lake or Reservoir Water Supply Area Municipal Park Regional Park Provincial Park
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Table 1: Comparison of the Annual Number of Field Visits and Numbers of Bullfrogs Removed in the Western Communities Control Corridor - 2007-2011

CONTROL CORRIDOR SITES	VISITS 2007	TOTAL CATCH 2007	VISITS 2008	TOTAL CATCH 2008	VISITS 2009	TOTAL CATCH 2009	VISITS 2010	TOTAL CATCH 2010	VISITS 2011	TOTAL CATCH 2011	2007-2011 TOTAL VISITS	2007 - 2011 TOTAL CATCH
Amy's Pond	8	871	10	661	5	55	3	27	4	17	30	1631
Fisher's Pond	0	0	1	12	2	14	3	54	3	59	9	139
Florence Lake	24	1,038	24	995	35	1532	26	706	14	404	123	4675
Glen Lake	16	1,377	17	379	8	30	6	12	19	2,128	66	3926
Goudy's Pond	5	298	3	191	5	338	5	202	3	34	21	1063
Humpback Reservoir	4	22	4	3	3	1	5	17	18	52	34	95
Irwin Ponds	3	70	5	29	2	7	6	109	11	227	27	442
Lake Ida Anne	3	116	3	100	2	81	2	65	2	34	12	396
Langford Lake	7	75	9	241	12	292	9	174	7	126	44	908
Langford Lake Ponds	1	57	2	95	2	37	3	72	6	247	14	508
One K Pond	NA		NA		NA		NA		1	1	1	1
Orchard's Pond	NA		NA		NA		NA		2	2	2	2
Spencer Road Pond	0	0	1	39	1	5	1	11	1	4	4	59
Turner's Bog	7	136	3	34	1	1	0	0	2	36	13	207
TOTALS	78	4,060	82	2,779	78	2,393	69	1,449	93	3,371	400	14,052

Figure 1 - Comparison of the Number of Field Visits to Remove American Bullfrogs from the Western Communities Control Corridor Annually Between 2007-2011

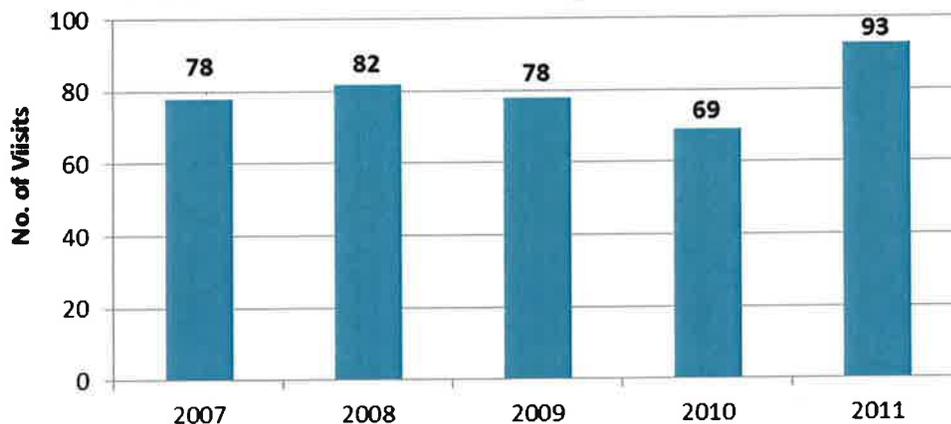
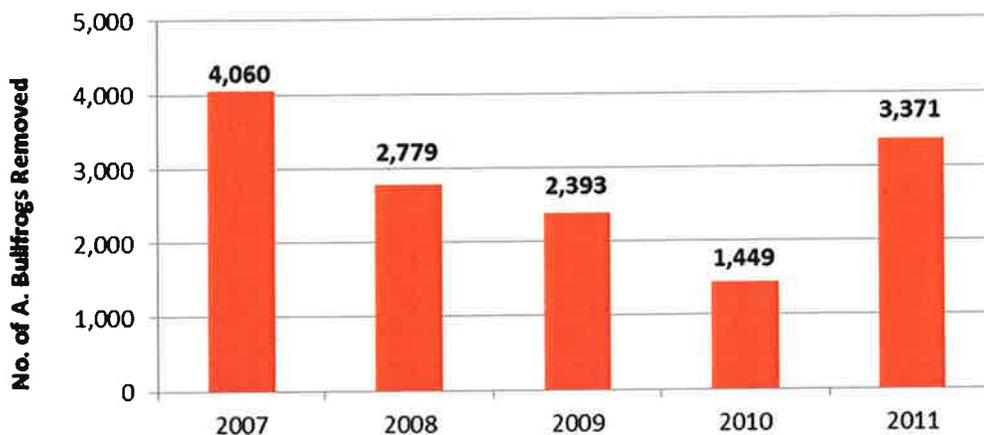


Figure 2 - Comparison of the Number of American Bullfrogs Removed from the Western Communities Control Corridor Annually Between 2007-2011



Bullfrog Eradication Program Results – CRD 2011

Prepared by Stan A. Orchard, R. P. Bio., March 2012

HISTORICAL CONTEXT

This program began with an unsolicited applied science research, experimentation and development plan written by me and presented in its final form in January 2005. I warned that bullfrogs were on the verge of entering the Victoria Watershed but that they should and could be prevented from doing so by managing a 'control corridor' at the isthmus of the Saanich Peninsula, e.g. lakes and ponds between Esquimalt Lagoon and Finlayson Arm. The plan was then taken to various government agencies, including CRD Water and CRD Parks, to try to secure funding to implement the plan. The City of Langford was the first to contribute towards this work, followed shortly thereafter by both CRD Water and CRD Parks. Langford's interest was to clear invasive bullfrog populations from the municipality, and the CRD's primary interest was to keep American bullfrogs out of the Victoria Watershed by depopulating lakes and ponds in a control corridor stretching from Finlayson Arm to Esquimalt Lagoon. I was also interested in advancing public awareness of the bullfrog menace and to exploring the possibility of advancing the long-term goal of eradicating bullfrogs from the entire Saanich Peninsula.

2005

Complications, delays, and a budgetary shortfall impeded progress in 2005. For example, the Province determined that a permit was required to capture and kill invasive alien bullfrogs. I applied for the permit in early-April but did not receive it until early-September. This meant that for virtually the entire 2005 active season I was unauthorized to capture and euthanize bullfrogs in British Columbia. An objection was also raised by the Province concerning the proposed method for euthanizing the catch. This necessitated contacting amphibian specialists, physiologists, neurophysiologists, and zoo and wildlife veterinarians for endorsement of the fact that cold is a natural anaesthetic for amphibians. The proposed 2-step euthanizing protocol cools the bullfrogs to around 2^o Celsius overnight and then they are put into a deepfreeze for at least 48 hours. In fact, bullfrogs are naturally in a cold-induced stupor at the bottom of local lakes and ponds for six months of the year. It was subsequently determined that the bullfrog program was not within the jurisdiction of the Canadian Council on Animal Care's guidelines which recommends the use of chemical anaesthetics and toxins. The brief controversy did, however, point out for the record that my proposed euthanizing protocol was the most practical and humane as well as the most eco-friendly (chemical-free) method available. Logistically, 2005 was spent finding assistants, establishing a base of

operations, assembling equipment, surveying prospective sites, and devising, testing, and refining the equipment for the primary manual capture technique, 'electro-frogging'. Only \$35,000, or 40% of the projected budget, was raised in 2005.

2006

In 2006, the program focused primarily on five lakes in the Western Communities: Langford Lake, Glen Lake, Florence Lake, Lake Ida Anne, and Goudy's Pond. This was the first year that electro-frogging was employed in a dedicated way as a capture technique. As in 2005, the budget fell short of its target minimum and the release of funding was delayed until mid-June and exhausted by early September. A major expense was incurred when it was determined that the program required an annually renewed \$3 million dollars in third-party liability insurance. Due to the novel nature of the work it was very difficult to find a broker who would insure the program. The resulting policy, at \$5,000 per annum, was a major hit to the budget. Although the electro-frogging equipment was now fully functional, 2006 was still an experimental phase where the team was confronted with various obstacles related to manoeuvring through problematical habitats to locate, approach, and capture bullfrogs. These necessitated acquiring and adapting new pieces of equipment and also modifying and refining the basic equipment. The experience and skill sets we accumulated over the 2006 field season moved us beyond the initially hypothetical aspects of the program. In total, 546 adult and juvenile bullfrogs were collected in 2006.

2007

In 2007, the CRD approved and released their funding for this program prior to the onset of bullfrog activity in April. Consequently, 2007 was the first year that fieldwork was conducted throughout an entire bullfrog activity cycle (April to October). The single 2-person team worked virtually every night that weather permitted, e.g. not raining or too windy. This amounted to 89 nights of effort within the 'control corridor' for a total catch of 4,284 adult and juvenile bullfrogs. We also demonstrated that this technique could produce capture rates as high as 240 in approximately 2.5 hours. A major accomplishment was producing the benchmark first full-season of data to which the capture rates and results per site could be fairly compared to those in subsequent years.

2008

The 2008 field season was essentially a repeat of 2007 with respect to 'control corridor' sites. However, the CRD contribution to the budget increased from \$30,000 to \$40,000. We collected bullfrogs at 12 lakes and ponds over 90 nights which resulted in a total catch of 3,020 adults and juveniles. Of particular significance were results from Amy's Pond and Glen Lake. These two sites turned out to be landmark case studies in bringing to light some basic units of bullfrog

control and eradication. This is because one successful spawning had occurred at each site in 2005 and this cohort of tadpoles began to transform in mid-summer 2007. The process of tadpole transformation was completed by mid-summer 2008. Both case studies produced remarkably similar results that suggested predictable patterns in bullfrog behaviour and population growth. Recognition of these patterns is helpful in finding answers to many questions associated with bullfrog colonization, population growth, and in assessing the time and effort required to entirely clear any given lake or pond of bullfrogs of all age-classes. By the end of the 2008 field season bullfrog numbers at both Amy's Pond and Glen Lake had been brought down from hundreds to zero in two years at capture rates that kept pace with metamorphosis and immigration. One complicating factor in 2008 was the need to respond to bullfrogs that turned up in the District of Metchosin. Since Metchosin is beyond the bounds of the 'control corridor' this development required urgent attention. However with only one 2-person team and only so many nights available per season, any geographical expansion of the program will necessarily dilute the effort at core sites.

2009

This year was basically a continuation of the *modus operandi* first established in 2007. In total, we worked on 88 nights within the 'control corridor' and collected 2,393 adult and juvenile bullfrogs. While the nightly routine stayed the same, the distribution of time and effort per site shifted. On the one hand, there was continuous immigration of bullfrogs into the 'control corridor' from established populations to the east in the municipalities of Highlands, View Royal, and Saanich. To the south were newly discovered, and as yet isolated, populations of bullfrogs in Metchosin. Bullfrog numbers were down dramatically at all core sites going into 2009, so I made the decision to reduce the number of visits per site within the 'control corridor' in an effort to extinguish the Metchosin problem and to reduce the influx of bullfrogs from populations on the eastern outer periphery of the 'control corridor'. Diluting our effort per site was obviously risky. The ideal would have been to deploy at least one more team, but this was not an option because the required additional funds could not be found to hire, train, and equip them. As a consequence of fewer visits per site, spawning occurred at Goudy's Pond, Fisher's Pond, Irwin Ponds, Langford Lake Ponds and Glen Lake in 2009. This was a set-back that would require another two to three seasons to completely mop up once these tadpoles began to metamorphose in 2010. The last remnants of this reproduction should be gone by mid-summer 2012.

2010

In 2010, over 83 nights we collected 2,349 adult and juvenile bullfrogs within the 'control corridor'.

HIGHLIGHTS OF 2011

In 2011, the program collected a record number of adult and juvenile bullfrogs ($n = 5,172$) from lakes and ponds on southern Vancouver Island, including a brief trip to assess North Pender Island. This has brought our grand total, since 2007, to 20,178. Over 70% of these were collected within the CRD control corridor. Where densities were high we collected as many as 300 in one 2.5 hour session. Weather was an issue this year as the spring and early summer produced an unusually high number of cool nights of wind and rain that prevented us from conducting fieldwork.

Other notable achievements include having finally gained full US and Canadian patent rights for the electro-frogger technique. I am partnering with the Washington-based company Smith-Root in the manufacture and distribution of this equipment. The Arizona Fish & Wildlife have bought two units and are planning an expanded cross-border program with the Government of Mexico. The first in a series of papers on results from the bullfrog program has been published in the book: Veitch, C. R.; Clout, M. N. and Towns, D. R. (eds.). 2011. Island invasives: eradication and management. IUCN, Gland, Switzerland. The book is accessible in pdf on-line at <http://www.issg.org/publications.htm#IslandEradication>. Other open access resources include the CABI/USDA/Development Consortium's Invasive Species Compendium bullfrog datasheet, which I was engaged to compile and write (<http://www.cabi.org/isc>). An analysis of the stomach contents removed from 5,200 adult and juvenile bullfrogs is in final draft form and will be published later this year.

A 2011 application to Environment Canada's Invasive Alien Species Partnership Program was once again rejected. The bullfrog program continues to operate with only sufficient funds to keep one 2-person team in the field full-time throughout the bullfrog's active season, approximately mid-April to early October.

2011 RESULTS

In 2011, we spent 95 nights on 16 lakes and ponds within the 'control corridor'. In total we captured 3,462 adult and juvenile bullfrogs, including 425 males, 264 females, and 2,772 juveniles.

CONCLUSIONS

1. With the right techniques, bullfrog control and/or eradication is feasible and practical.
2. The now proven techniques developed through this program are currently the leading edge in bullfrog control technology.

3. The basic unit of operation for this manual capture technique is one 2-person team. Each team can cover one lake or pond per night to a total of approximately 120 nights per season. This total of nights must then be divided between the number of lakes and ponds requiring attention. Having quantified the capabilities and limitations of one team, it is evident that the program needs more manpower to comprehensively cover the lakes and ponds within the 'control corridor' as well as clearing problematical populations, such as in Metchosin, and adjacent populations, such as in Highlands, from which bullfrogs will inevitably reinvade cleared sites within the 'control corridor'. Additional funds are required before I can enlist, train and equip a second team. Without additional manpower there is only so much that one team can accomplish in any given year. It would cost about \$40,000 to add a second full-time 2-person team to this program. A second team would enable us to intensify our efforts at difficult sites, respond quickly to emergency situations, and expand the program geographically without diluting our efforts within the 'control corridor'.

4. In 2011 there was a 'blip' in the numbers of juveniles and young adults within the 'control corridor'. This was almost exclusively the result of an inevitable increase relating to the spawnings that occurred in 2009 and the subsequent mass metamorphosis of those tadpoles beginning mid-summer 2011. Consequently, 80% (n = 2,773) of the 2011 catch were juvenile bullfrogs, and 73% (n = 2,011) of these were from Glen Lake. The remainder of the Glen Lake metamorphosis cohort will have completed their transformations by mid-summer 2012. From there on we will be simply mopping-up residual juveniles at Glen Lake and tracking down those that would have migrated away from the lake before we could get to them in 2011. The catch numbers for 2012, therefore, will be dramatically lower than in 2011 and most sites within the 'control corridor' are expected to be bullfrog-free by the end of the 2012 field season.

5. Since 2007, this program has amassed an unprecedented amount of original data on bullfrog biology and control and the impact of invasive bullfrogs on local ecosystems. The 'electro-frogging' technique is a home-grown innovation that has produced unprecedented results in confronting and managing a bullfrog invasion. On the other hand, the general public has had very limited opportunity learn about the program in detail. Thus, it would be beneficial to the program, and in the public interest, to share the program's experience and results in an interpretive way through public forums and workshops. This could be accomplished relatively inexpensively as side projects scaled to different audiences and different municipalities. It is a simple matter of securing venues and the time required to prepare, co-ordinate, publicize, and present. If the workshops are conducted during the day on weekends they would not conflict with our night-time fieldwork. Therefore, I think that the CRD should consider sponsoring or co-sponsoring a formal effort to report back to the public on the progress of this on-going and CRD-sponsored program.

TABLE 1. Chronology and Results of Fieldwork Within the 'Control Corridor' 2011

SITES	VISITS	M	F	J	TOTALS 2011	NOTES
Amy's Pond	April 11	0	0	0	0	12°
Amy's Pond	May 13	0	0	1	1	18°
Amy's Pond	June 19	2	0	2	4	22.5°
Amy's Pond	Aug 1	5	5	2	12	25°
		7	5	5	17	
Bear Mountain Pond #3	Aug 17	26	12	49	87	21°
Bear Mountain/Highlands Golf Course	Aug 24	2	1	1	4	
		28	13	50	91	
Fisher's Pond	May 9	0	0	0	0	Too flooded to launch boat
Fisher's Pond	June 23	0	0	4	4	19.4°
Fisher's Pond	Aug 16	13	2	40	55	20°
		13	2	43	59	
Florence Lake	April 17	0	0	0	0	10°
Florence Lake	April 26	0	0	10	10	14°
Florence Lake	May 12	2	1	27	30	16°
Florence Lake	May 23	3	1	29	33	17°
Florence Lake	May 26	0	1	26	27	17°
Florence Lake	June 2	3	1	18	22	18°
Florence Lake	June 5	0	0	29	29	22°
Florence Lake	July 10	14	10	13	37	22°
Florence Lake	July 13	11	8	13	32	22°
Florence Lake	July 28	12	10	1	23	24°
Florence Lake	Aug 6	8	6	2	16	25°
Florence Lake	Aug 7	20	11	10	41	24°
Florence Lake	Aug 9	12	11	5	28	23°
Florence Lake	Sept 14	11	21	44	76	22°
		96	81	227	404	
Glen Lake	May 17	0	0	8	8	18°
Glen Lake	June 21	19	6	4	29	24°
Glen Lake	June 27	5	3	4	12	22°
Glen Lake	July 6	4	0	0	4	25°
Glen Lake	July 15	7	0	0	7	22°
Glen Lake	July 17	14	4	0	18	22°
Glen Lake	July 18	10	6	0	16	22°
Glen Lake	July 23	5	5	1	11	24°
Glen Lake	Aug 5	1	3	1	5	24°
Glen Lake	Aug 10	7	5	26	38	24°
Glen Lake	Aug 26	2	0	59	61	25°
Glen Lake	Sept 9	1	2	295	298	24°
Glen Lake	Sept 11	0	5	292	297	24°
Glen Lake	Sept 19	1	0	250	251	20°
Glen Lake	Sept 20	2	0	260	262	20°
Glen Lake	Sept 22	0	0	271	271	20°
Glen Lake	Sept 25	0	0	143	143	19°

Glen Lake	Sept 28	0	0	205	205	18°
Glen Lake	Sept 29	0	0	192	192	
		78	39	2011	2128	
Goudy's Pond	May 8	2	1	16	19	14°
Goudy's Pond	June 24	3	5	4	12	20°
Goudy's Pond	July 2	3	0	0	3	22°
		8	6	20	34	
Humpback Reservoir	May 24	1	2	6	9	17°
Humpback Reservoir	June 6	0	1	7	8	21°
Humpback Reservoir	June 9	0	0	1	1	1 captured by Nigel
Humpback Reservoir	June 12	0	0	1	1	1 captured by Nigel
Humpback Reservoir	June 17	1	0	5	6	20°
Humpback Reservoir	June 24	0	0	1	1	1 captured by Nigel
Humpback Reservoir	June 28	0	0	2	2	2 captured by Nigel
Humpback Reservoir	July 5	1	0	1	2	2 captured by Nigel
Humpback Reservoir	July 19	2	2	2	6	20°
Humpback Reservoir (pond)	July 24	0	0	2	2	
Humpback Reservoir	Aug 2	1	0	0	1	1 captured by Nigel
Humpback Reservoir	Aug 12	3	3	0	6	23°
Humpback Reservoir	Aug 18	2	0	0	2	2 captured by Nigel
Humpback Reservoir	Aug 23	0	0	2	2	22°
Humpback Reservoir (pond)	Aug 24	0	0	2	2	
Humpback Reservoir	Aug 31	1	1	0	2	22°
Humpback Reservoir	Sept 6	0	0	1	1	1 captured by Nigel
		12	9	33	54	
Irwin Ponds (E)	May 3	0	0	12	12	12°
Irwin Ponds (W)	May 5	0	0	2	2	13°
Irwin Ponds (E)	May 29	0	0	30	30	15°
Irwin Ponds (W)	June 9	4	0	28	32	19°
Irwin Ponds (E)	June 22	0	3	21	24	20°
Irwin Ponds (W)	June 28	6	3	12	21	19°
Irwin Ponds (W)	July 22	9	2	2	13	20°
Irwin Ponds (E)	July 26	0	0	1	1	1 captured by Nigel
Irwin Ponds (E)	Aug 4	14	5	23	42	22°
Irwin Ponds (W)	Aug 12	5	8	1	14	23°
Irwin Ponds (E)	Aug 21	2	1	33	36	21°
		40	22	165	227	
Lake Ida Anne	Apr 19	0	0	0	0	9°
Lake Ida Anne	May 19	4	0	30	34	16°
Langford Lake	June 1	0	0	2	2	18° - south end bay at the boardwalk
Langford Lake (N end)	July 20	12	8	4	24	
Langford Lake (George's Bay)	July 21	7	6	1	14	22°
Langford Lake (N end)	July 27	8	3	2	13	23°
Langford Lake (S end)	July 29	6	3	0	9	22°

Langford Lake (N end + George's Bay)	Aug 18	20	6	0	26	23°
Langford Lake (Georges Bay & South Bay)	Sept 8	6	11	1	18	24°
Langford Lake (N end)	Sept 13	4	15	1	20	23°
		63	52	11	126	
Langford Lake Ponds (E & W)	April 19	0	0	0	0	12° - no evidence of activity
Langford Lake Ponds (E & W)	May 9	1	0	11	12	17°
Langford Lake Ponds (E & W)	July 11	29	15	4	48	22°
Langford Lake Ponds (W)	July 30	5	0	3	8	Interrupted by boat puncture
Langford Lake Ponds (E & W)	July 31	19	13	40	72	26°
Langford Lake Ponds (E & W)	Aug 27	7	0	100	107	25°
		61	28	158	247	
One K Pond (Humpback)	July 22	1	0	0	1	
Orchard's Pond	July 24	0	1	0	1	
Orchard's Pond	Aug 10	0	1	0	1	Collected by Nigel
Spencer Road Pond	May 30	0	1	3	4	18°
Turner's Bog	July 12	1	1	1	3	21°
Turner's Bog	July 14	13	3	17	33	20°
		14	4	18	36	

TABLE 2. Effort/Capture Results from 16 Sites in the Control Corridor 2007 – 2011

CONTROL CORRIDOR SITES	VISITS 2007	TOTAL CATCH 2007	VISITS 2008	TOTAL CATCH 2008	VISITS 2009	TOTAL CATCH 2009	VISITS 2010	TOTAL CATCH 2010	VISITS 2011	TOTAL CATCH 2011	TOTAL VISITS/CATCH 2007 - 2011
Amy's Pond	8	871	10	661	5	55	3	27	4	17	1,631
Bear Mountain Pond #3	NA	NA	NA	NA	NA	NA	2	85	1	87	172
Bear Mountain/Highlands Golf Course	NA	NA	NA	NA	NA	NA	NA	NA	1	4	4
Fisher's Pond	0	0	1	12	2	14	3	54	3	59	139
Florence Lake	24	1,038	24	995	35	1,532	26	706	14	404	4,675
Glen Lake	16	1,377	17	379	8	30	6	12	19	2,128	3,926
Goudy's Pond	5	298	3	191	5	338	5	202	3	34	1,063
Humpback Reservoir	4	22	4	3	3	1	5	17	18	52	95
Irwin Ponds	3	70	5	29	2	7	6	109	11	227	442
Lake Ida Anne	3	116	3	100	2	81	2	65	2	34	396
Langford Lake	7	75	9	241	12	292	9	174	7	126	908
Langford Lake Ponds	1	57	2	95	2	37	3	72	6	247	508
One K Pond	NA	NA	NA	NA	NA	NA	NA	NA	1	1	1
Orchard's Pond	NA	NA	NA	NA	NA	NA	NA	NA	2	2	2
Spencer Road Pond	0	0	1	39	1	5	1	11	1	4	59
Turner's Bog	7	136	3	34	1	1	0	0	2	36	207
TOTALS	89	4,284	90	3,020	88	2,393	83	2,349	95	3,462	445/15,508

TABLE 3. Capture Numbers Sorted by Size-class/Gender 2011

SITES	Young Males 80-120 mm	Mature Males > 120 mm	Young Females 80-120 mm	Mature Females > 120 mm	Juveniles < 80 mm	TOTALS
Amy's Pond	7	0	5	0	5	17
Bear Mountain Pond #3	17	9	9	3	49	87
Bear Mountain/ Highlands Golf Course	2	0	1	0	1	4
Fisher's Pond	13	0	2	0	44	59
Florence Lake	82	14	71	10	227	404
Glen Lake	78	0	35	4	2011	2128
Goudy's Pond	6	2	5	1	20	34
Humpback Reservoir	11	1	7	2	31	52
Irwin Ponds	40	0	22	0	165	227
Lake Ida Anne	3	1	0	0	30	34
Langford Lake	62	1	50	2	11	126
Langford Lake Ponds	56	5	26	2	158	247
One K Pond	1	0	0	0	0	1
Orchard's Pond	0	0	2	0	0	2
Spencer Road Pond	0	0	0	1	3	4
Turner's Bog	14	0	4	0	18	36
TOTALS	392	33	239	25	2773	3462