Vermicomposting Pilot Project: in the Life Sciences Center

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Abstract

This research study took place at Dalhousie University on the Studley Campus in the Life Sciences Center (LSC). The purpose of this study was to assess the feasibility of using vermicomposting, or worm composting, as a method of waste diversion from landfills and as an educational tool for students, staff and faculty. Other objectives included determining if the LSC had adequate composting collection bins. The methodology is made up a triangulation of a student and faculty questionnaire, two Dalhousie University staff interviews and a vermicomposting pilot project. As a form of pre-work, a literature review was done to better understand other vermicomposting projects that have taken at universities across Canada. Students and faculty believe that composting is an important activity to pursue but many do not compost while in the LSC. It was also found that there is support for vermicomposting projects in the LSC and addition of extra organic waste collection bins. Currently at Dalhousie University there is only one compost collection bin per 200 students. Finally, the vermicomposting pilot project found that worms can be kept in the LSC and that they can thrive there. It is clear from the survey results that not enough people are composting in the LSC, this means that the compost facilities must be improved, regardless of whether this involves the use of vermicomposting or not. By the implementation of a small-scale vermicomposting system in offices and departmental lounges, composting in the LSC would become participatory in nature. The conclusions resulting from this study are that vermicomposting in the LSC is feasible and that there is support for it, that vermicomposters can be used as educational tools to teach people about the benefits of composting and that the LSC does in fact require more compost collection bins.

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1.0 Introduction

Every year the average Canadian creates about 670 kg of waste (CBC News, 2001). According to Environment Canada, between 40% and 60% of this waste could be separated into compostable material (Environment Canada, 2002). Conventional composting is defined as a biological process that uses microorganisms to make waste materials into a product that closely resembles soil (Environment Canada, 2002).

The benefits of this type of composting are numerous with the most important one being that waste is diverted from overburdened landfill sites. Furthermore, composting "helps complete the carbon cycle by returning the carbon to the nonliving environment by decomposing plant and animal matter" (Environment Canada, 2001) by using the composted materials in gardens. The inherent benefits of composting make it not only desirable but also essential to creating a sustainable environment.

1.1 What is Vermicomposting?

Another type of composting called vermicomposting, or worm composting, is a process that entails using worms to aid in the decomposition of organic waste into a black, earthy smelling, nutrient-rich soil otherwise known as worm castings. Vermicomposting is an excellent technique for decomposing food waste and is the simplest and most cost-effective method of composting. This is because the costs of collection and transportation are avoided as it can be done in your own home (Dickerson, 1999).

This research project was spurred on by two observations. The first was the perceived lack of composting collection bins in the Life Sciences Center (LSC) on the Dalhousie Studley Campus in Halifax, NS. Currently, students, faculty and staff are required to travel considerable distances from their offices or classes with their compostable items to find a compost collection bin. This is because there is only one compost collection bin within the entire building.

The second observation was that at present, there are no anti-diversionary composting methods being used on Dalhousie Campus. An anti-diversionary composting method is one that does not simply divert waste from landfill sites by sending it to a large composting facility, but actually entails putting the waste to some other use at the site of origin. Vermicomposting is an excellent example of an anti-diversionary composting method. It was believed that this perceived lack of knowledge, interest, education and care for composting on the Dalhousie Campus warrants investigation. To adequately address this study's research problem these primary and secondary research objectives were used.

1.2 Objectives

Primary Objectives:

- To assess the appropriateness of a vermicomposting system on campus.
- To evaluate how well a vermicomposting system will be received by students, faculty and staff at Dalhousie University.
- Determine if the LSC has sufficient compost collection bins

Secondary Objectives:

- To attempt to popularize the process of composting and organic waste separation by introducing concept of vermicomposting.
- To create a by-product (nutrient-rich humus) that can be used in gardens or potted plants on campus.
- To reduce the amount of waste being sent to the HRM (Halifax Regional Municipality) landfill and composting sites.

To establish a vermicomposting system in the LSC, or in a home or office, a few essential materials are required. The first is a container that does not allow light to enter with holes at the bottom for aeration. After creating suitable bedding, which is dampened paper or cardboard, worms are added to the vermicomposter (Cochran, 2004). The most popular worm used by almost all vermicomposters is the *Eisenia foetida* or red wigglers (Cochran, 2004). Once the system gets going, a red wiggler can eat up to its own body weight in a day producing organic rich castings that can be

used as fertilizer (Dickerson, 1999). The worms are hermaphroditic (have both male and female sex organs), and can produce over a dozen offspring every 14-21 days (Unknown, 2005; Cochran, 2004).

1.3 Benefits of Vermicomposting

There are many benefits to vermicomposting that are agreed upon by most expert vermicomposters (Unknown, 2005).

Vermicomposting:

- Is a way to dispose of your food scraps without burdening the composting facilities or landfills.
- It teaches people about the carbon cycle and responsible waste disposal (Educational)
- It centralizes composting on site and prevents fossil fuel consumption associated with transportation to composting facilities
- It provides your houseplants with free and nutritious worm 'castings' (a great soil conditioner for gardens and indoor plants)
- It allows you to grow your own free worms for use as pet food or fishing bait.
- It is an odorless composting method.
- Worm castings in the vermicomposters can contain up to 5 - 11 times more essential nutrients such as nitrogen, phosphorous, and potassium, than traditionally composted material (Dickerson, 1999).

1.4 The Research and the Research Problem

A team of four students from the ENVS 3502 class have investigated composting and vermicomposting in the LSC through a survey of Dalhousie students and faculty. Interviews with staff and the implementation of a month long, small scale vermicomposting pilot project completed the investigation. The assistance of Dr. Tarah Wright, Dalhousie University's Facilities Management Department and other key members of the University's faculty was obtained for the smooth running of the study.

Before this research study started a literature review was conducted. This was done to gain insight into what other vermicomposting studies have been conducted, along with understanding their strengths, weaknesses and conclusions. This was important in the initial stages of this project so that

this study could be better planned and appropriate methods could be assessed. The literature review can be found in Appendix A of this report.

This research project took place in the Life Sciences Center at Dalhousie University and has significance to every member of the Dalhousie University population as it directly affects their options for waste disposal. However, this study could also have broader implications for researchers and environmentalists alike. Anyone who, in the future, may be interested in establishing or expanding upon a vermicomposting system may look to our findings to determine appropriate methods of implementation.

Since part of the study was a pilot project aimed primarily at evaluating the feasibility of vermicomposting in the LSC, the findings would be useful for encouraging an expansion of the vermicomposting stations in the LSC and additional university buildings. The pilot project that was implemented also has the potential to spread outwards from its starting point at the LSC to the rest of campus, to other universities, to offices and households throughout the Halifax Regional Municipality.

The implementation of vermicomposting projects at universities are great tools for promoting awareness of the importance of composting and the additional benefits of vermicomposting. Results of our pilot project have the potential to influence the installation of more vermicomposting bins in the LSC, allowing more people to compost, effectively lessening the organic waste that is sent needlessly to the landfill.

This report includes the methodology used for all research tools along with sections dedicated to the results. Following this will be a discussion of the outcomes and how the different results from each tool relate to one another. After the discussion section the final conclusions and recommendations made by the researchers will be identified.

2.0 Nominal and Operational Definitions of Terms

2.1 Nominal Definitions of Terms:

- Anti-Diversionary Composting Methods- Methods of composting which do not merely divert waste from landfill sites, but find alternative uses for wastes on site.

- Compost: a mixture of material that consists largely of decaying organic waste.

- Composting: Conventionally, the process in which solid organic materials are decomposed in the presence of oxygen through the action of bacteria and other microorganisms (The Biosolids Lifecycle, 1999).

- Compostable Materials: can consist of yard and garden waste, kitchen wastes such as fruits, vegetable peelings, tea bags and coffee grounds, and wood ashes in thin layers. Meat, fish, bones, oils, dairy products, pet litter, weeds, and diseased plants should be avoided (Compostable Materials, 2005).

- Eisenia foetida: commonly known as red wigglers, branding, or manure worms (Elcock,1995).

- Environmental Sustainability: Environmentally sustainable activities do not deplete environmental resources faster than they can be regenerated, or threaten the viability of ecological systems (The White Paper on Local Government, 1997)

- Feasible: A plan or project that is practical and workable.

- Humus: a brown or black complex variable material resulting from partial decomposition of plant or animal matter and forming the organic portion of soil (Merriam-Webster, 2005).

- Organic: Of, relating to, or derived from living organisms (Merriam-Webster, 2005).

- Qualitative Research Methods: Research methods that attempt to understand the truths of reality; characterized by a belief that one cannot truly understand a phenomenon without being close to it (Palys, 2003 pp. 434).
- Quantitative Research Methods: Research methods that focus on numbers and facts; researchers prefer to keep a distance from that which they are researching (Palys, 2003 pp. 434).

- The Greening the Campus Movement: A project designed to "use the campus as a laboratory for demonstrating how to create sustainable communities" (Kay, 2004).

- Vermicomposting: The process of using worms and many microorganisms to produce black, earthy-smelling, nutrient rich humus from organic waste (Cochran, 1997).

- Waste Diversion: The process of diverting waste from landfill sites to other areas such as recycling plants or composting facilities.

2.2 Operational Definitions of Terms:

- Anti-Diversionary - organic waste that is broken down on site by red wiggler worms and converted to humus using the process of vermicomposting in the LSC.

- Compost : A mixture of organic food waste that originates from food vendors on campus or lunches brought from home that is eaten and deposited in compost collection bins in the LSC. It is then either sent to a regional composting facility or is used in vermicomposting bins on the eighth floor of the LSC.

- Composting: Depositing organic food waste in receptacles labeled 'organic waste' or 'compost' in the LSC.

- Compostable Materials: In a vermicomposting system, a variety of different forms of food waste which red worms are capable of breaking down. Some foods which may be included are all vegetable and fruit waste, pasta leftovers, coffee grinds, tea bags, and egg shells. Large amounts of mean, fat, and bone should be avoided (Cochran, 1997).

- Eisenia foetida: This is the type of worm that will be used in the vermicomposters on the eighth floor of the LSC.

- Environmental Sustainability: a concept which is used to assess the degree to which the pilot project vermicomposters are capable of converting waste back to a natural and useable form.

- Feasible: The practicality of using vermicomposting in the LSC.

- Humus: The by-product created by vermicomposters located on the eighth floor of the LSC.

- Organic: The type of materials that are collected from the eighth floor copy room and the second floor Earth Science student lounge of the LSC and used in the vermicomposting bins on the eighth floor of the LSC. Examples are banana peels, apple cores and coffee grounds.

- Qualitative Research Methods: These include personal interviews with staff from Dalhousie's Facilities Management Department, the vermicomposting pilot project in the LSC and a survey administered to students and faculty of Dalhousie University.

- Quantitative Research Methods: Survey administered to, students and faculty of Dalhousie University.

- The Greening the Campus Movement: A movement that attempts to add more environmental sustainability to universities such as Dalhousie that has spawned this research project on composting and vermicomposting in the LSC.

- Vermicomposting: Using red wiggler worms to aid the process of composting organic material collected from the eighth floor copy room and the second floor Earth Sciences student lounge. The vermicomposters consist of two large Tupperware bins that are located in the cactus room

on the eighth floor of the LSC on the Studley campus of Dalhousie University, Halifax, NS during the month of March 2005.

- Waste Diversion: Actions taken that reduce the amount of waste that is sent to from the LSC at Dalhousie University to landfill sites. This includes methods such as composting and vermicomposting in the LSC

3.0 Methodology:

Methods used in this study include a triangulation of three research techniques and a pre-study review of literature. Using multiple research techniques increases the reliability of the information (Palys, 2003). The triangulation was made up of a questionnaire of 1-2 classes within each Department of the Life Sciences Center (LSC). In addition to this, interviews were carried out with two Dalhousie University staff regarding the implementation of a vermicomposting pilot project in the LSC. Finally, a pilot vermicomposting project was set up in the LSC, focusing organic waste collection specifically on the eighth floor copy room and the second floor Earth Science student lounge.

3.1 Review of Literature

A part of the methodology that was not considered with the triangulation was the literature review. This was a very important aspect of this study as it placed this work in the context of what has already been done. It also allowed researchers to investigate what approaches were successful in other projects and assisted avoiding the approaches that were not successful (Palys, 2003). The procedure for this part of the methodology involved the use of websites found in the ENVS 3502 Class Syllabus such as those for the University of Waterloo Environmental Studies term projects. Also quick searchers were performed by using the Google search tool. Appendix A has a full account of the literature reviewed and summaries of the material are also included.

3.2 Survey of Dalhousie University Student Body and Faculty

3.2.1 The Purpose

The purpose of the questionnaire was to determine what a sample of students and faculty from Faculty of Science Departments within the LSC felt and knew about composting practices in Dalhousie University's LSC. Also assessed was their attitude towards the implementation of a vermicomposting pilot project. In this questionnaire only student or faculty who were currently taking classes or working in the core Departments based in the LSC (meaning Oceanography, Earth Science, Biology, Environmental Science and Psychology) were considered. Appendix B contains a copy of a questionnaire.

In a situation such as this, it is not reasonable to issue a questionnaire to all students and faculty who have classes or work in these Departments. Therefore, it was decided that 1-2 classes from each were needed to gain a large enough sample population. Only six faculty members filled out questionnaires and this was done on a convenience basis.

A population is defined as who, or what specifically, make up the studies' target group from which the sample is drawn (Palys, 2003). In this project, the population was all students and faculty taking classes from the core Departments of the Life Sciences Center. A total of 235 students completed questionnaires and 6 Faculty members.

The student sample was not representative as the distribution did not match that of the target population (Palys, 2003). This is because the sample did not exactly mirror the population of students. The total population of students was not determined and as a result sampling proportions in this study were different from those actually found within the departments. The faculty population was even less representative of reality and this was due to time restrictions.

3.2.2 Sampling Technique and Research Tool

The type of sampling techniques used for questionnaire administration was haphazard (also known as convenience, or accidental) and purposive. The questionnaire was purposive as only students or faculty who take classes/work in a department in the LSC would be considered. The sampling technique for the questionnaire can also be termed 'convenience' as sampled classes were chosen based on the researchers' previous experiences with professors in different departments. The research team found that it was easier to approach professors who already knew them to ask permission to perform a questionnaire in their class, rather than approaching a stranger.

The research tool used for the student survey was a group administered questionnaire. Individuals were in their regular classes when they completed the questionnaires. They were in the company of other students who were also completing the surveys. The researchers were present to answer any questions regarding the questionnaire and to collect them when the students were done.

This method was used to try and avoid researcher bias that can be found in other questionnaire types and because it has a high response rate (every student present in the class took part). This was more effective than asking students entering the LSC about their composting habits because in that situation, only students interested in the topic will do the survey. In this situation all students in the classroom took part, even those who were un-interested in composting or vermicomposting. The downfalls of this tool are that the respondents' privacy was not ensured, as students next to one another could look at one another's replies. This could also result in a respondent's answers being influenced by others, or by their perceptions of what the researchers were looking for.

The faculty questionnaires were face to face questionnaires, as only the administrator and the faculty member were in the room together. Again, this allowed the faculty member to ask questions, however anonymity was lost.

3.2.3 The Procedure

The procedures used for the questionnaire were the following:

1. Questionnaire was generated for Project Proposal (Due February 8, 2005). Ethics Approval Forms were handed in.

2. Dr. Tarah Wright reviewed the questionnaires, and changes were made. Ethics Approval obtained. Please see Appendix

3. Four pilot tests were performed and changes were made based on the feedback received from the respondents. Included in Appendix B is a copy of an un-answered questionnaire.

4. Two students organized when and where questionnaires would take place. Each professor was approached in person and asked if a questionnaire in class was possible and dates were set up.

5. Reminder e-mails where sent the day before the questionnaire was administered.

6. The classes where questionnaires took place are the following:

    - OCEA 3420: Geochemistry of Aquatic Environments -> M. Kienast
      Wednesday March 9, 2005

    - ERTH 1050: The Earth and Society II-> Dr. L. Plug
      Wednesday March 9, 2005

    - ERTH 2440: Intro to Geomorphology -> Dr. L. Plug
      Tuesday March 8, 2005

    - ENVS 1000 Y: Introduction to Environmental Studies-> K. Tae
      Thursday March 10, 2005

    - DISP: Psychology -> Dr. J. Stamp
      Thursday March 17, 2005

    - BIOL 3065: Conservation Biology -> Dr. B. Worm
      Friday March 11, 2005

7. In the classroom the researcher(s) present were introduced as Environmental Science students and gave a quick introduction to vermicomposting. Questionnaires were passed around and students were told if they had any questions to not hesitate to ask them.

8. In three of the six classes where questionnaires were administered, Vermicomposting Bin #1 was brought to the class and students were able to ask more specific questions and look at the worms.

9. When it came to Faculty Questionnaires, the faculty member was approached in his/her office and asked if he/she had time to complete a 10 minute questionnaire. If this was possible the researcher sat with the respondent in order to answer any questions that arose.

10. After the 235 student questionnaires, and the 6 faculty questionnaires were performed they were placed in a sealed envelope and given to another researcher who input the data into an excel spreadsheet.

11. Each question was coded and data was entered. The data was analyzed producing different types of graphs, such as multi-level pie charts and histograms.

12. After 0.3 years or 4 months, the questionnaires will be shredded and possibly used as bedding for the vermicomposting bins.

3.3 Interviews with Dalhousie Staff

This part of the project consisted of two formal interviews and one discussion based talk. The Dalhousie staff interviewed was Mike Murphy, who works for Dalhousie Waste Management and Recycling Services on campus, and Gary Gaudet who is with Dalhousie's Custodial Services in the LSC.

3.3.1 The Purpose

The purpose of interviewing these two key Dalhousie staff members was to gain perspective on what they thought or felt about vermicomposting and their general attitude towards the implementation of a pilot project within the LSC. Also discussed was the feasibility of large and small-scale vermicomposting operations in the LSC.

The focus of the discussion was placed on the implementation of a small-scale pilot project in the LSC and data on organic waste collection at Dalhousie University. The continuation of this project past the end of the 2005 winter semester was also discussed. There was also a discussion about the possibility future of vermicomposting on the small scale and large scale on the Dalhousie Campus. The final reason for these interviews was just to let the interviewees know that this project was going on and to make sure that if contributions were not made to the pilot study compost collection bins that compost from food services and the LSC would be available.

3.3.2 Sampling Technique and Research Tool

This type of sampling is considered to be purposive sampling as the researchers intentionally sought out these two particular staff members. The instrumentation or tool of this research was an interview. Purposive sampling is a form of non-probabilistic sampling, where people and locations are found because they meet specific criteria of the study (Palys, 2003). This form of sampling is not representative of the total population of staff that works at Dalhousie University. Representativeness may be crucial at some times but it can sometime impede the research by over loading the researchers with unneeded results. In the case of this project a representative sample was not needed because these staff members were purposively sought out to gain answers to specific questions.

The interview tool used was called a face to face interview. This type of interview is when the researcher and the subject meet face to face and the researcher asks questions of the respondent. In a general sense these research tools have high participation rates and decrease volunteer bias as participants are more likely to do an interview where they can react with the researcher. However, they are time consuming (Palys, 2003).

This measure was appropriate as it had significant benefits over an in-person questionnaire. The biggest benefit of this type of tool was that it allowed for interaction between the interviewer and the respondent and it allowed answers to be expanded on and opinions voiced (Palys, 2003). This means that more pertinent information was obtained. It was also important to distinguish between the general student population and those people who are part of the University staff. This is because the University staff has the ability to make decisions and explain important rules and regulations that guide the University.

During the interviews open-ended and closed structured questions were asked. Some of the questions from the questionnaire were also asked of both respondents (Appendix B). Gary Gaudet was asked questions: 3, 4, 5, 6, 7, 12, 14, 16 and 17 from the questionnaire and Mike Murphy was asked

questions: 3, 4, 6, 14 and 16 from the questionnaire. Appendix C has a copy of the additional questions asked of Mike Murphy and Gary Gaudet, most of which was to promote discussion based on the obstacles involved in the implementation of the vermicomposting pilot project.

3.2.3 The Procedure

The procedures used for the questionnaire are the following:

1. During Environmental Problem Solving II class time, it was mentioned that most students would need to talk with Mike Murphy who is part of Dalhousie University Waste Management and Recycling Services on campus. It was later determined that Gary Gaudet who is a supervisor in the LSC for Dalhousie's Custodial Services was also an important person to talk with.

2. Mike Murphy was contacted by e-mail and an initial discussion time was set for March 15, 2005. This was an informal interview/conversation during which a discussion occurred concerning the vermicomposting pilot project for the LSC and its implementation. This interview lasted approximately 1 ¼ hour.

3. A formal interview was set up with Mike Murphy via e-mail for March 18, 2005. At the beginning of the interview, a consent form was signed (Appendix D). It was during this interview that questionnaire questions were posed along with the additional questions found in Appendix C. Responses were written down and are discussed in the results section. This interview lasted approximately ¾ h.

4. An e-mail was written to Gary Gaudet however, a response was not received. On March 29, 2005 Gary Gaudet was contacted in person, in his office in the LSC, and an interview was conducted as this time. At the beginning of the interview, a consent form was signed. During this interview questionnaire questions were posed along with the additional questions in Appendix C. The interview lasted approximately ½ h.

5. After each interview was complete, the interviewee was thanked for their time.

3.4 Implementation of Vermicomposting Pilot Study

The third and final portion of the methods triangulation was the implementation of a pilot study on vermicomposting. In order to assess the most appropriate and effective way to begin a vermicomposting program on campus, two vermicomposting bins were set up in the Cactus room of the Greenhouse on the eighth floor of the LSC. Included in this part of the study was an educational session held to make students, staff and faculty aware of the pilot project and to provide information about the benefits and mechanics of vermicomposting.

Two organic waste collection bins were established in the LSC in order to have organic waste for the vermicomposter. These bins were the large Imperial Margarine containers and were placed in room 816 of the LSC, (the eighth floor copy room) and in room 2009 B (the second floor earth science student lounge) in the Earth Science Department. Each bin was labeled *composting bin* and on the wall above the bin was a colorful poster made with a piece of bristol board explaining what vermicomposting is and what organic waste should and should not be deposited in the collection container, (corresponding to what organic waste should and should not be used in the vermicomposter).

3.4.1 The Purpose

The purpose of this pilot study was to assess aspects of the vermicomposting process and the possible methods of implementation within the LSC. The researchers set out to assess the following:

- Where the vermicomposting worms could be kept.
- If the two collection bins would be used by students in the Earth Science students lounge and by faculty and staff in the eighth floor copy room.
- How much food the worms could consume during the test period.
- If the vermicomposting process was difficult to do, effective at breaking down the organic waste added to the vermicomposter, whether the vermicomposter had a distinct odor and whether pests were associated with the process.
- The interest in vermicomposting from the general student population, by holding an information session at the main entrance into the LSC, with a vermicomposting bin on site, on March 23, 2005 between 12:00 pm and 3:00 pm.

The implementation of a pilot study is an appropriate measure of the effectiveness of vermicomposting in the LSC, as it allows for the assessment of the students reception of the process as well as the faculty and staff. The test bins allowed for demonstrations and mini-lectures for classes participating in the questionnaires and allowed students and others the chance to see vermicomposting worms and ask questions about how they work.

3.4.2 The Procedure

The procedures used for pilot study are the following:

1. In order to start the pilot project, worms were required. Contact was made February 2, 2005 with Dennis Hartt who runs The Worm Firm, in Windsor Nova Scotia. From Mr. Hartt it was learned that 1 cubic Ft. of space per Lb of worms is a conventional amount but this number could be reduced. It was also learned that 1 lb or worms cost approximately $40.00.

2. On February 9, 2005 Dr. T. Wright posted an e-mail from Johanna Nesbitt from The School for Resource and Environmental Studies, Dalhousie University.

3. An e-mail was received from Dr. Tarah Wright that indicated a lab in the LSC was selling two pre-made vermicomposting bins for $25.00. For this price two Rubbermaid containers with pre-cut holes, peat and red wiggler worms were included. The contact name given was Melanie Wilson (mwilson4@dal.ca) and she was contacted about purchasing the worm bins later that same evening by e-mail.

4. Dennis Hartt was contacted on the 14th of February to say that we were unable to afford 40 dollars per pound and had found a good deal from another student. He was thanked for his time and patience.

5. On February 17, 2005 the two vermicomposting bins were picked up by the researchers and taken into the Earth Science lounge where they stayed for one day. On the 18th they were taken to one of the researchers homes so that they could be cared for during spring break.

6. During Spring Break, Carmen Mills (the Greenhouse manager) was contacted in person to discuss worm bin placement within the eighth floor Greenhouse in the LSC.

7. On March 3, 2005 the vermicomposting bins were placed in the Cactus room of the eighth floor Greenhouse.

8. On March 4, 2005 permission was obtained from the Dean of Sciences Office for the placement of a compost bucket in the eighth floor copy room, as well permission was obtained from the acting chair of the Department of Earth Science for the placement of a bin in the Earth Science student lounge.

9. Each week general assessments of worm bin health were made and a feeding list was constructed.

10. On March 8, 2005 compost collection containers and small signs were placed in the Earth Sciences lounge and the eighth floor copy room.

11. On March 16, 2005 larger vermicomposting signs replaced the smaller signs in both locations.

12. On March 14, 2005 Worm Education signs were placed around the LSC explaining what vermicomposting is and that there would be a chance to see the worms on March 23, 2005 from 12:30-3:00 pm around the main third floor entrance of the LSC.

13. On March 16, 2005 bedding material was added to both vermicomposting bin 1 and vermicomposting bin 2 as both no longer had bedding. This was done by cutting used newspaper and boxboard into narrow strips, soaking them in water and then ringing out the excess water the night before. The next day the material from the left side of the bin was pushed over to the right and the bedding was placed in the hole that was formed on the left side of the vermicomposting bins. Finally, some soil material was moved back on top of the new bedding. At this date labels were placed on the bins showing what side had the bedding and what side to add organic material to.

14. The feeding dates were as follows: March 3rd, 7th, 9th, 11th, 14th, 15th, 16th, 17th, 18th, 21st, 22nd, 23rd, 24th, 28th, 29th, 31st ,April 1st , 4th , 5th, 6th, and 8th 2005. The material fed to the worms was recorded and can be viewed in Appendix E.

15. Watering of the worm bins was done when the bin contents started to become dry. This was done on a required only basis and was not recorded.

16. Removal dates of vermicomposting bin # 1 for promotional, educational or in class questionnaires occurred on; March 9th, March 10th, March 23rd, and on April 5th, 2005.

17. In early April the worm bins will be removed from the greenhouse and placed into another location as the temperature in the Cactus Room will be increasing dramatically.

3.5 Chosen Method of Analysis

Each portion of the triangulation underwent different forms of analysis. The results for the questionnaire of students and faculty were analyzed quantitatively with the bulk of the information being reported in graphs. This was the best way of analyzing this data as it allowed for percentages to be generated and comparisons to be made. Also, it was not feasible for a qualitative analysis to be performed on a large sample as seen with the results from the questionnaire.

The interviews with Dalhousie staff were performed in a qualitative manner. No graphs of their responses to specific questions were generated. Since these interviews were interactive, it made more sense for the analysis to be flexible and not narrowed by the limitations of quantitative analysis.

Finally, the vermicomposting pilot project was also analyzed in a qualitative manner. This part of the triangulation could have been strengthened by having qualitative measurements of how much material the worms ate, and by measuring the pH, temperature and different contents of the waste.

However, with the time restrictions that occurred it wasn't possible for this type of analysis to be set up.

3.6 Reliability and Validity

The issues of reliability and validity are always of concern when it comes to any form of research. In general, the term reliability deals with the consistency or the repeatability of results. Therefore by providing detailed descriptions of the three methodologies, repeatability has been established.

The questionnaires given to students had reliability with respect to their administration but not when deciding in what classes they should be performed. When giving out the questionnaire to students and faculty, there was consistency from one use to the next as it was always administered by one or two of the four students involved in the research. The reliability of the results decreases when the method of choosing classes to be surveyed is considered. This is because classes were chosen for convenience and if this study were to be repeated by another group of students classes surveyed would not be the same.

When it comes to conducting the interviews with Dalhousie staff there was strong reliability. This was because if other researcher were to come to Dalhousie and interview Mike Murphy and Gary Gaudet by asking them the same questions, they would have found the same results.

With respect to the vermicomposting pilot project, the method has strong test-retest reliability as the pilot study was administered with two vermicomposting bins which both produced the same result. Palys (2003) defines this type of reliability as consistent between the definitions of an attribute. This part of the project also had inter-rater reliability, as other researchers would be able to read the procedures for implementation and proceed to make the same judgments.

When dealing with validity a researcher must look at whether measurement instrument or test measures what it set out to measure or what it was supposed to measure (Palys, 2003). Meaning, what is the extent to which the measurement is free of systematic error? There are three types of validity

considered; the internal (how much something correctly maps the phenomenon in question), external (how well it can be applied to similar circumstances) and catalytic (does the research empower others who use it?) validity.

This questionnaire tool had internal and catalytic validity. This is because it correctly mapped students' knowledge about composting and vermicomposting. It also had strong catalytic validity as questionnaires were well received and students were generally interested in learning how the vermicomposters worked.

The pilot study aspect of this research had internal, external and catalytic validity. The pilot project correctly mapped that which it was set out to do and the pilot study had catalytic validity as it 'empowered others by enhancing their self understanding and shows them the possibility of transformation' (Palys, 2003).

3.7 Limitations

With respect to the limitations or restrictions over which the researchers have no control were the following:

- All the researchers are Environmental Science students therefore bias was present as it was assumed by the researchers that the subject matter was important; however this may not be a universal belief.
- The largest limitation encountered was regarding time:
    - The vermicomposting bins were already in working order when received. However, it requires approximately three months to produce the final vermicomposting soil product.
    - The timeline from proposal to final project did not allow for a detailed study of vermicomposting processes, ie. the reproduction rate.
    - Based on when the vermicomposting bins were purchased and the Spring Break, the pilot test period was only 1 month long.
    - The researchers wanted to perform more faculty and staff questionnaires to obtain their thoughts on vermicomposting and the issues surrounding it implementation however, this would have required too much time as individual surveys are very time consuming

    - Limited by the length of the questionnaire when performing it in a classroom. More questions wanted to be asked on the questionnaire however surveys should not be more than 1 page double sided as to not waste the class time of professors and students.

- Financial Limitations were also encountered as only two vermicomposting bins could be purchased.

- The amount of food placed into the two collection bins was beyond the researchers control therefore a system was set up to receive more compostable materials if this had become an issue. Also it was not possible to weigh the organic waste material that was added to the vermicomposters.

- The questionnaire would have been termed more reliable had a representative sample been taken and if classes taking part in the questionnaire were chosen by random sampling (choosing the attribute at random, where every attribute has the same probability of being chosen).

3.8 Delimitations

The limitations that were deliberately imposed on the research design were the following:

- Looked generally at composting habits on Dalhousie University Studley Campus

- More specifically issues of vermicomposting and composting were addressed in more detail at the Life Sciences Center on Studley Campus.

- The two vermicomposters were kept in the Greenhouse. This was an important delimitation because it was the only place where the vermicomposters could be placed.

- Used only two compost collection bins so that the vermicomposters were not overloaded by organic material.

- Questionnaires of students, staff and faculty only were performed on those people who had classes or worked in the LSC.

- Questionnaires were only performed in 1-2 classes from each department.

- Interviews were performed only on 2 key staff members on the Dalhousie Studley Campus.

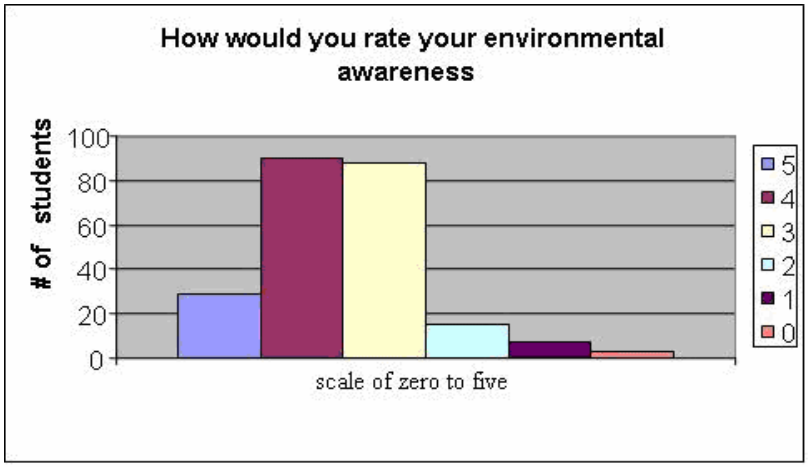
4.0 RESULTS

4.1 Survey of Dalhousie Student Body and Faculty Members

Through a two-week period, questionnaires were administered to 235 students in classes and to 6 faculty members in the LSC who were willing to answer the questionnaire. The survey results from the students and faculty were analyzed separately because the research team believed that it would be interesting to compare and contrast the status of the individual surveyed and the answers they gave. The response rate was approximately 100% since it was in a controlled environment of the classroom or an office.

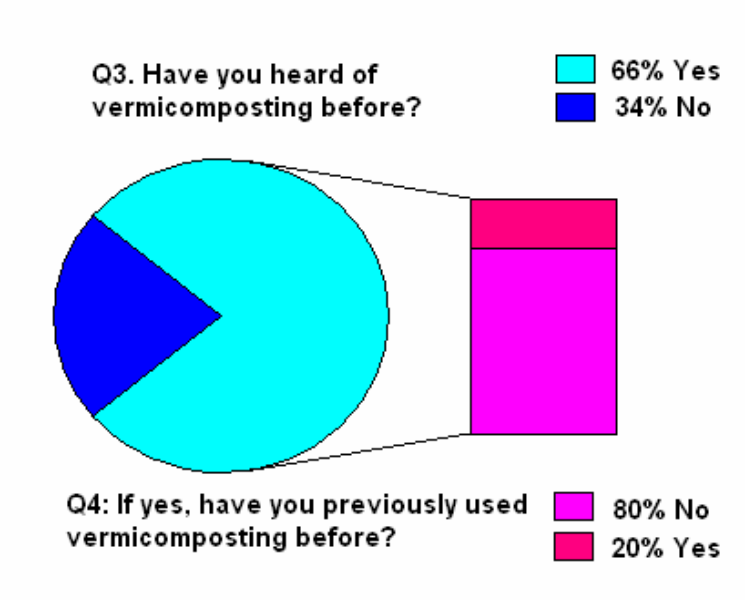
Pertinent information was drawn from these student surveys can be seen in Appendix F. The students indicated that they had an above average level of environmental awareness (3.5 on a scale of 0 to 5) (*Figure 1*) with 66% having heard about vermicomposting before the survey (*Figure 2*).

Figure 1



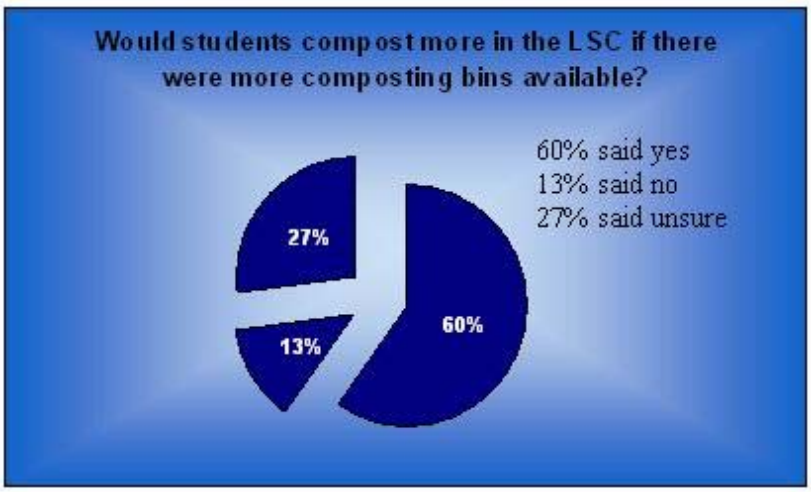
Of the 153 participants that heard of vermicomposting, only 20% have actually used vermicomposting (*Figure 2*).

Figure 2:



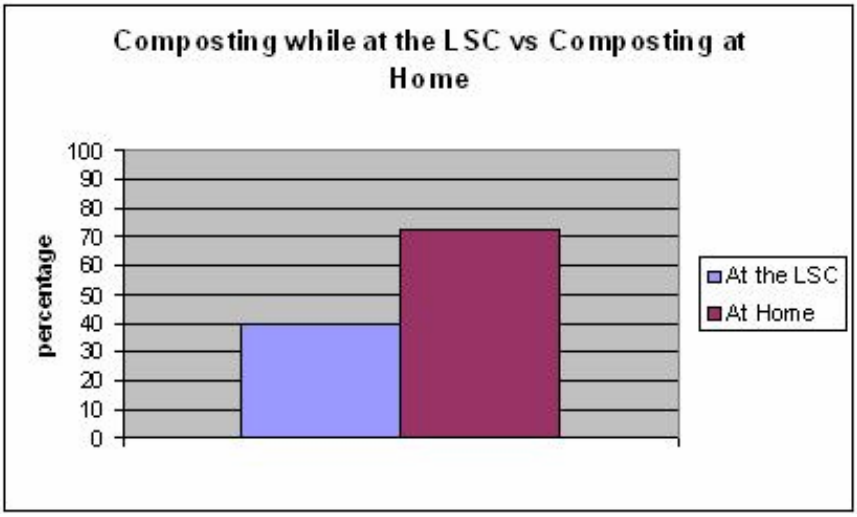
The majority of the students (99%) agreed that composting is important. With respect to food services located in the LSC, 59% of the students said they would compost more if there were more composting bins available (*Figure 3*).

Figure 3



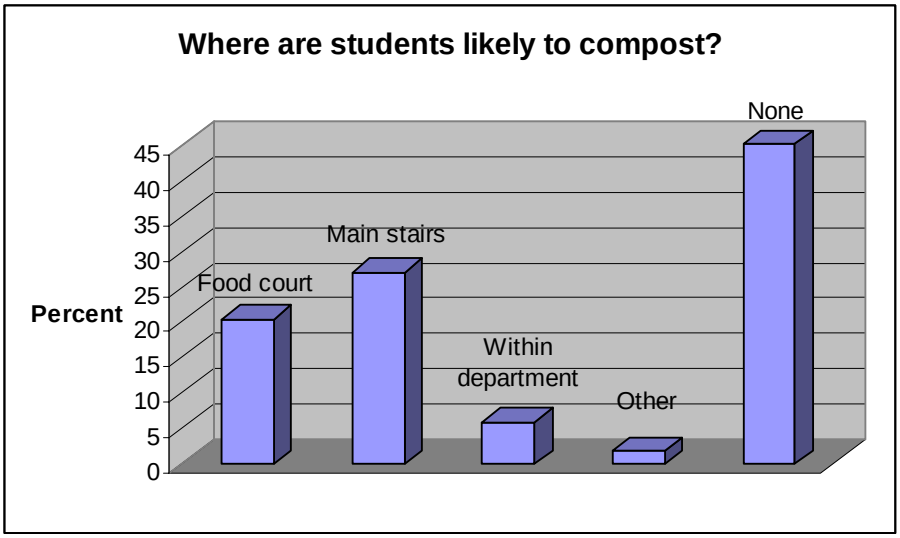
In comparison, 40% of the individuals surveyed said that they compost in the LSC with 73% saying that they compost at home (*Figure 4*).

Figure 4



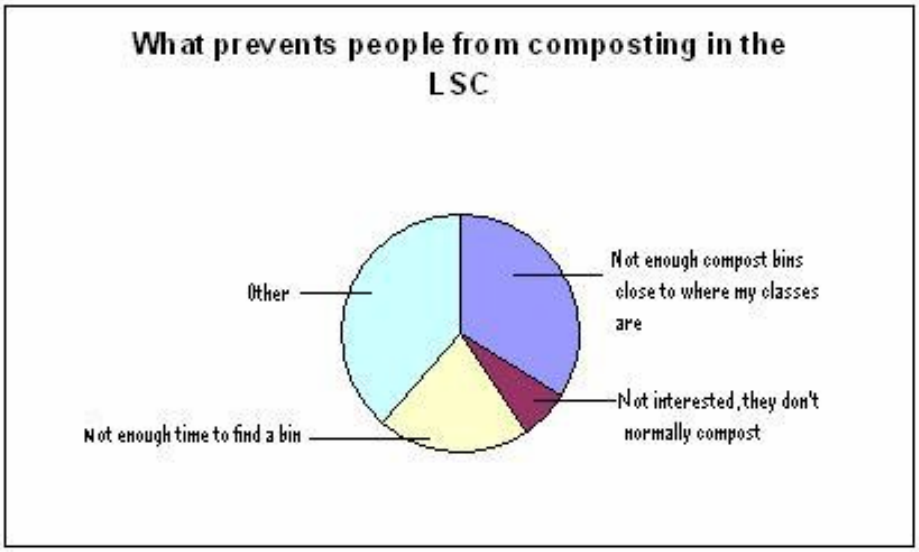
About 63% of the 235 surveyed say that the LSC does not have adequate compost collection bins. Out of the 90 participants that compost at the LSC, they compost an average of 1-4 times a week and are most likely compost in the food court or the main stairs (*Figure 5*).

Figure 5



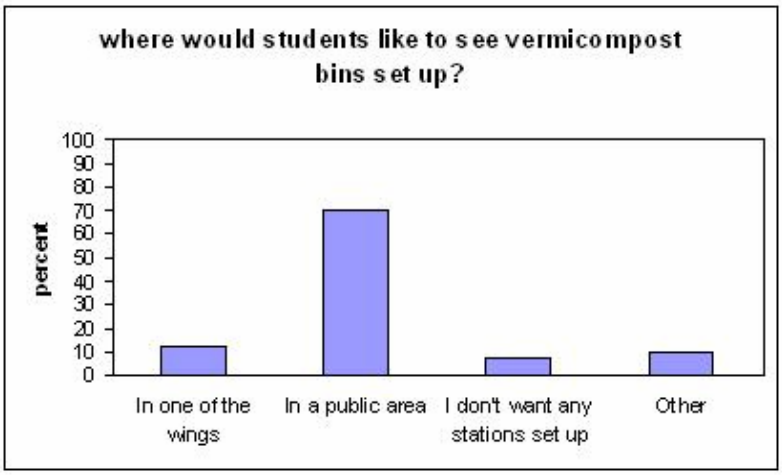
Students main reason for not composting more often while in the LSC was that there are not enough compost bins in the vicinity of their classes or that there is not enough time to find a bin (*Figure 6*)

Figure 6



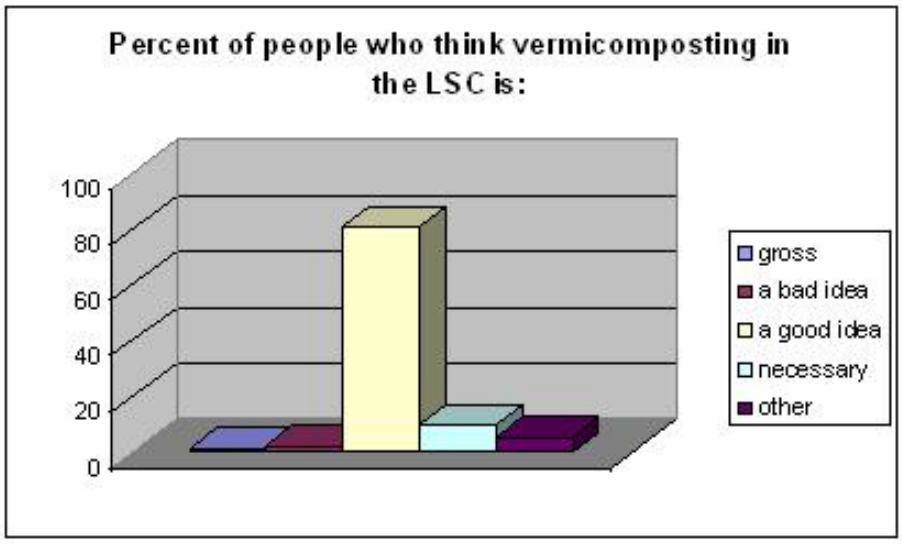
Seventy percent of those surveyed would like to see a vermicomposting bin set up in a public area (*Figure 7*) like a student lounge (11%), a hall way (44%), or the museum in the biology wing (25%).

Figure 7



In conclusion, the majority of students deem vermicomposting in the LSC as either a good idea (81%) or necessary (10%) (*Figure 8*).

Figure 8



Faculty members answered the questionnaire similarly to the students however, there were some slight differences (Appendix G has all the faculty data). The six faculty members surveyed rated themselves more environmentally aware then the students at an average of 4.5 on a 0 to 5 scale. Only one faculty member had not heard of vermicomposting before but of the five that did, two have previously used vermicomposting. All of the faculty members surveyed practiced composting at home with only 2 regularly composting in the LSC.

The common problem that faculty members experience is that there is not enough compost bins located near their offices'. With respect to food services in the LSC, 5 out of 6 faculty members surveyed said that the LSC did not have adequate compost collection bins. The results were inconclusive when the faculty members were asked if they would compost more in the LSC if there were more composting bins available with 2 saying they would, 1 saying he would not, and 2 saying they were unsure because it depended on where the bins were placed.

Interestingly, 3 out of 6 faculty members surveyed said that they do not think that food services in the LSC do an adequate job to promote separation of organic waste. Also worth noting was the observation that of the faculty members surveyed agree with the surveyed students, saying that vermicomposting in the LSC is a good idea and is necessary.

4.2 Interviews with Dalhousie Staff

Interviews occurred with two members of Dalhousie University staff. The first interview was with Mike Murphy from Facilities Management and the second was with Gary Gaudet from Custodial Services in the LSC.

Mike Murphy had had prior knowledge of vermicomposting as he took part in a pilot project in 1994 at Dalhousie University. He also saw organic waste separation on campus to be very important, as it is law in Halifax Regional Municipality (HRM). Mike Murphy was concerned that our project would cause more work for Dalhousie's custodial staff. He explained that they do not have the manpower to handle such a project.

When HRM changed the law requiring everyone in the regional municipality, including the university, to separate their organic waste and recyclables from regular waste, the amount of work that facilities management needed to do to collect waste from Dalhousie's buildings significantly increased. This happened without making more money available in the budget to pay for the four extra people needed to collect the waste.

When considering adding new waste collection bins on campus Dalhousie's Facilities Management Department has to look at how much extra work will be required to collect the waste from them. Facilities Management is planning to put 23 new bins that they already have in stock into the Student Union Building, the Dentistry Building and the Tupper Building in the very near future. It is possible that a few of these bins will make their way into the LSC. Also, Mike Murphy made sure that no new bins were placed in the LSC during the course of this project as survey questions were

asked to determine if there were enough compost collection bins in the LSC. There are only two compost collection bins for the LSC at present. One of these bins is on the stairs between the second and third floors close to the Tim Horton's and the second one is just outside of the third floor doors.

The large containers on campus that have four separate holes for garbage, compostables, paper and recyclable bottles are called OMG containers, after the company that makes them. The company is based out of New Glasgow, Pictou County, Nova Scotia and is called OMG Atlantic. Dalhousie does not pay for the OMG containers but the company must be able to use the containers for advertising in return for their free installation. The OMG containers are each worth $2200.

Dalhousie and OMG are currently working out the details of a contract to have a total of 50 OMG containers on campus, fourteen of which are already in place. The hold up is a debate on what the company can and cannot advertise using the OMG containers and this debate needs to be settled before the contract is finalized. The company is also trying to have the OMG containers implemented on the streets of Halifax and is asking Halifax City Council if they want them.

As it is now, considering that there are approximately 16 000 students at Dalhousie University, there is one compost collection bin for every 200 students. If the 23 small bins that Facilities Management already has and the additional 36 OMG containers are put into place there will be 115 composting containers per Dalhousie student.

Mike Murphy was very adamant in his opinion that the vermicomposting pilot test worms bins should not be placed in a public place where people passing by would have access to them. This is because he felt that the worm bins would be tampered with and there would be an extremely high probability that this would result in the worms dying or the failure of the project.

Facilities Management and Custodial Services did not have room for the worm bins within the LSC. According to Mr. Murphy, the MuColluc Museum, the greenhouse and private labs were all areas where there was the possibility for the placement of the vermicomposting bins. Student lounges

and hallways were thought to be too risky. Also it was Mr. Murphy's opinion that any permanent vermicomposting programs would be best done in a building or area where people are very supportive of it, like with the Environmental Programmes Department or with Dalhousie's School for Resource and Environmental Studies.

Facilities Management has focused their efforts of collecting compost from the highest generation areas on campus like cafeterias. In the future Mike Murphy does not see Dalhousie taking on a large-scale industrial sized vermicomposting project. Reasons for this are that it is contrary to the current waste management plan that the city of Halifax has set out for organic waste collection and disposal. The current infrastructure is to truck all of the city's organic waste to a central composting facility. Another reason is that it would be very expensive for the Dalhousie Community and would require a large space on campus to run taking into consideration that currently, each year, Dalhousie University generates 160 tones of organic waste.

Mike Murphy said that the city probably chose to truck the compost away because it makes it accessible for most people and easy for the majority of people to participate in the program. An example of this is that not everyone in urban Halifax could compost in their backyards because many people do not have backyards and even more people would not like this idea. Mr. Murphy sees the Facility Management plan for organic waste collection in the future to continue on the course that it is on now with a focus on improving the current system.

Gary Gaudet from Custodial Services in the LSC was the second interviewee. Mr. Gaudet had not heard of vermicomposting before he was asked about it and the process was explained to him. He felt that the idea of feeding worms inside in a bin was a bit gross at first and did not understand the concept of our project before it was explained. After he became more accustomed to the idea he thought that it was a good one and appropriate on a small scale at Dalhousie University, or, more specifically in the LSC. He didn't see vermicomposting becoming a fixture in all offices in the LSC.

Mr. Gaudet also had the same opinion as Mr. Murphy that the worms should not be kept in an area where just anyone could access them. He added that some people might have a real problem if the worm bins were kept in the same room that people eat in. Mr. Gaudet felt that in the future, however probably quite far down the road, large-scale vermicomposting could happen at Dalhousie University. But that this would depend on cost and whether the student body was very supportive of the idea and pushed for it.

When asked why people do not separate their waste while on campus Gary Gaudet offered the explanation that it could be a lack of education, or that the people that do not compost simply do not care enough to. Another reason he gave is that HRM's law requiring organic waste separation is fairly new and that sometimes it is hard to get people to change their habits. In other words, 'old habits die hard'. To combat this he said that education, videos and possibly even signs in certain areas might help.

Mr. Gaudet said that he wasn't sure if the new OMG containers would help get more people to separate their waste and that he does not have a problem with the advertising that will go on them.

4.3 Implementation of Vermicomposting Pilot Study

Two individual vermicomposting bins were set up at beginning of March in the Cactus Room in the Greenhouse on the 8th floor of the Life Science Centre. All researchers were responsible for general maintenance and supervision of the bins and feeding the worms when they were not busy. Communication within the group made it easier to deal with problems with the bins. At least bi-weekly visitation by group members maintained the moisture levels within the vermicomposting bins and the levels became easier to maintain as the bins' environment improved.

As stated throughout the methodology organic waste collections stations were set up in the Earth Science student lounge and on the eighth floor in the copy room. Small posters were placed above the deposit bins so that people would know why the organic waste was being collected and

where it was going. The response was excellent and more then enough food was deposited in the stations' containers.

The worms were fed only a small amount of organic waste in the beginning, with the amounts gradually increasing over the course of the experiment. By watching the time in which the organic material was breaking down, it was observed that the bioactivity of the bins took about a week to reduce food waste into unidentifiable material. The most surprising observation that came out of this experiment was that the vermicompost bins produced no unpleasant odor. The bins produced a nice, earthy aroma like fresh fertilizer bought at a hardware store.

Recently, the researchers have noticed what are thought to be white mites in the bin. With additional research, it was revealed that this is quite normal for vermicomposting bins and the mites are harmless and beneficial to the micro-ecosystem. Other pests such as fruit flies were seen only once or twice and these were dealt with by killing them and burying any food deeper into the bin. Mould was not a common problem since food was well covered under the soil, moisture levels were kept in check, and the amount of food added was carefully noted (see Appendix E). In the end, the worms were healthy and the bins were in good condition (*Figure 9*). The results from the experiment were positive.

Figure 9- the two vermicomposting bins in the Greenhouse of the LSC.

4.4 Educational Booth

On March 23rd 2005, an information booth was set up outside the food court on the 3rd floor LSC. This was a good way to introduce a large number of people to the project and also to spark discussion and questions. A poster set up behind the booth and pamphlets grabbed the attention of the busy students and faculty which lured them closer to the vermicomposting bin which we brought down from the greenhouse.

The information booth operated for two and a half hours and received a great response. General questions of the vermicomposting process and about the worms were common. People were curious about what type of worm was the best composter, why it was the best composter, and how do we know if the worms are hungry. One woman suggested that selling vermicomposting bins would be a great business for someone to start in the Halifax area. A vast diversity of students, faculty members, and maintenance staff stopped by during breaks in classes and work to observe the vermicomposting bin and try to get a glimpse of the red wigglers.

The pamphlets, done by one of the group members, give general information about vermicomposting and a way to contact the research team if anyone had any additional questions or concerns. The poster used for the information booth was the one that was used to gather attention to the organic waste collection station in the Earth Science student lounge. The excellent turn out was inspiring for the research group and it was exciting to see so many interested people come up to the table in the short time of two and a half hours.

5.0 Discussion

5.1 Summary of Research Purpose

The purpose of this research project was multifaceted. Primarily, the aim was to assess the feasibility of utilizing vermicomposting practices in Dalhousie University's Life Science Centre. The research team set out to determine the most appropriate applications for vermicomposting in this building; was vermicomposting appropriate at all? And if so, should it be implemented on a large or a small scale, or both to some degree?

Another aspect of this project involved an analysis of composting habits in the LSC. The researchers were interested in evaluating factors that may prevent or discourage students, staff and faculty from composting in the LSC. Overall, the researchers wanted to create an interest in conventional composting. Also the researchers wanted to test the applicability of a specific type of composting system, known as vermicomposting, which is not only more efficient, but also more environmentally sustainable.

5.2 Overview of Significant Findings

5.2.1Survey of Dalhousie University Student Body and Faculty

Several key findings within the questionnaires are noteworthy for the purposes of this study. The fact that 98.7% of respondents stated that they thought composting was important, suggests that composting in general has become almost universally accepted as worthwhile, and indeed, even necessary to maintaining a healthy environment. Despite high level of acceptance for composting, only 39.6% of students stated that they composted while at the LSC and 73% of respondents usually compost at home.

These findings demonstrated a huge discrepancy between the amount of students who compost in the LSC and those who compost at home. In addition to this, only 27.7% of respondents felt that the LSC had adequate composting facilities. Above all else, the responses to these questions justified this

research project. These results showed that the participants in the questionnaire had an interest in and willingness to compost, but for one reason or another, the majority do not compost while in the LSC.

It seems that, since the willingness to perform conventional composting practices is present, a system must be implemented that will both improve facilities and create an enthusiasm for composting in the LSC. Vermicomposting has the potential to do both of these things. Since 90.5% of respondents stated that they thought that vermicomposting in the LSC was either 'A Good Idea' or 'Necessary', it became apparent that, if nothing else, vermicomposting was something that those who frequent the LSC would be interested in.

Based on the fact that only a small percentage of respondents stated that they would take their compostable materials to another floor or another building, it would be most appropriate to set up vermicomposters in offices or student lounges where they are easily accessible to those who will be using them. Although approximately 75% of survey participants stated that they would like to see vermicomposters set up in public places, it was determined that this would not be feasible for this kind of compost system. This will be discussed in greater detail in the Dalhousie staff interview section.

Overall, responses to the surveys illustrated that there was a desire for improved composting facilities in general in the LSC. Respondents expressed an interest in vermicomposting in particular, and it must be noted that people are generally more likely to participate in something which they have an interest in to begin with. From the results of the surveys, it is believed that there is every reason to believe that vermicomposting bins would be used, if set up in areas such as faculty and staff offices or student lounges.

5.2.2 Interviews with Dalhousie Staff

The two interviews that were conducted with Dalhousie staff show support for this study. It is interesting to see the discrepancy between what the students answered on the surveys about where the worms bins should be placed and where Mike Murphy and Gary Gaudet thought that they definitely

should not be. Students answered that they though public places like hallways were a good place for the vermicomposting bin to go (survey questions 15 and 16). While Mike Murphy and Gary Gaudet were sure that having the worms in a high traffic or public place with no supervision, like a hallway, would be disastrous to the worms and the bin itself.

This shows that the questionnaire participant's level of knowledge about care required to keep the worms may be limited. Although the worm bins are not high maintenance you must bury the organic waste, you can not over load the bin with too much waste and certain foods like citrus and meat should not go into the vermicomposting bin. It would only take one person to ruin the bin. An example of this would be tipping the contents of the bin out or piling garbage into the bin. It is therefore the best practice to keep the vermicomposting bins in an area where there is limited or restricted access such as the eighth floor greenhouse.

The planned installation of new organic waste collection bins on Dalhousie Campus would increase the number of organic waste collection bins by 59. Mr. Murphy was unsure of whether any of the first 23 bins were definitely going to be placed in the LSC, although it was believed that some might. The date for the installation of the additional 36 OMG containers is dependant on the negotiations of the advertisements. This means that there is no clear plan for when more organic waste collection bins will be installed in the LSC.

5.2.3 Implementation of Vermicomposting Pilot Study

By setting up and monitoring two vermicomposting bins, the research team was able to evaluate the ease of use of the bins, the levels of interest in the bins, and the most practical placements for bins in the future. As described in greater detail in the Methodology section, the researchers placed two vermicomposting bins in the Cactus room of the LSC's Green House. One food collection bin was placed in the Earth Science lounge and one was placed in the eight floor copy room (both located in the LSC).

Prior to embarking upon this pilot study, the team was concerned that there would not be enough food donations to keep the worms healthy. However, plenty of organic food waste was placed in both locations for the worms, and they always had more than enough to eat. People who used both of these rooms seemed to take an active interest in the well-being of the worms. To some degree, the worms became like pets to not only the researchers, but also to those who were donating their food scraps. This was relevant to our study as it demonstrated that the practice of vermicomposting is engaging. It got students, staff and faculty interested in composting, and kept them interested as they developed a concern for the worms being used.

It was this interest in the well-being of the worms which, fostered through close contact with the process itself, which led the research team to conclude that vermicomposting in the LSC would be most practical on a smaller scale, in offices or student lounges. As previously mentioned, the majority of respondents stated that they would like to see vermicomposting bins in a public place. However, the nature of the bins demands that someone take responsibility for them. It also demands that users become educated on the requirements of the worms. In order for vermicomposting bins to be located in a public place, Dalhousie would have to hire a whole support staff to monitor and regulate use of the bins. This is impractical. By practicing vermicomposting on a small scale, the research team found that those who have access to the bins became very engaged in the process itself and were interested to learn the proper procedures for using the composters.

Throughout the pilot study, the researchers also found that vermicomposting was fairly user friendly, and a highly effective means of composting organic materials. The worms required fairly little attention and decomposed the food that was fed to them very quickly (usually within 4 to 5 days). By decomposing organic waste so quickly on site, vermicomposters are able to divert not only waste which would go to landfill sites, but also have the potential for reducing the amount of compost which must be shipped off of campus.

In short, vermicomposting is something that anyone can do with only a little bit of prior education and the results are both personally and environmentally rewarding. One potential shortcoming of placing individual vermicomposters in offices could be that there would be no one to care for these over Christmas holidays, and other times when offices may be left vacant. However, if the onus of care for the bins is placed on individuals who use the offices/lounges rather than the university, it is possible that someone could take the bin home with them for periods where they would otherwise be left unattended for longer periods of time. Another possibility would be that other faculty or staff would be able to care for the worms.

5.2.4 Educational Booth

The educational booth that was set up in the LSC provided valuable feedback to the research team in regards to the applicability of vermicomposters to patrons of the LSC. The interest generated by the booth furthered the belief that there was a great deal of support for vermicomposting in the LSC. It is worth mentioning here that several people asked for information about how they could set up their own vermicomposters, and two people actually asked us if they could purchase vermicomposters from us. This led us to believe that it would be interesting for a group in the future to investigate the degree to which people would be willing to pay for prefabricated vermicomposting bins for their offices. Despite the researchers' initial fear that people might be turned off by the idea of using worms to compost, the people who visited the booth were actually very interested in the worms and seemed to find them more intriguing than gross or unsanitary.

It was interesting that the majority of visitors to the information booth were from either the environmental or earth sciences departments. This might suggest that interest in vermicomposting is greater amongst people who already have some prior education in environmental issues in general. One recommendation for further vermicomposting initiatives in the LSC might be to begin to expand

facilities in these departments first, and then work through the rest of the building if it proves to be successful here.

5.3 Consideration of Findings in Light of Existing Studies

In forming the basis for research, the team consulted several similar studies which had been carried out in the past. Of these, the two most relevant studies came from the University of Waterloo. In 1994, research was completed on implementing vermicomposters in various offices on campus. In 2002, another study was done on placing vermicomposting bins in student residences. The results of these studies lead to suggestions similar to our own. In both studies at the University of Waterloo, it was found that vermicomposting works best when implemented on a smaller scale. Also these studies showed that there was a high percentage of support for vermicomposting on campus.

5.4 Implications for Practice and Theory

Overall, this project could have great implications for composting practices in the LSC. It is clear from the survey results that not enough people are composting in the LSC this means that the compost facilities must be improved in general, regardless of whether this involves the use of vermicomposting or not. By the implementation of a small-scale vermicomposting system in offices and departmental lounges, composting in the LSC would become participatory in nature. This would make the process more engaging and educational than a mere increase in regular composting bins. Since our worms are not only still alive, but thriving, this study has demonstrated that vermicomposting in the LSC can be done, with the right amount of dedication and understanding.

6.0 Conclusion

This completion of this project has been a very educational experience for the research team, and it is hoped that some of the conclusions drawn in this study will be considered both by future researchers and Administration at Dalhousie University.

First and foremost, vermicomposting, on a small scale is feasible in a building such as the Life Science Centre. However, it is not something which can be forced upon people. It must be carried out by individuals who are truly interested in and dedicated to preserving the well-being of the red wiggler worms who inhabit the compost bins. This being said, there seemed to be a high percentage of individuals who expressed an interest in vermicomposting. For many people, it is something new and different from their regular composting, and it has the potential to encourage people to compost when they might not have in the past.

Secondly, the practice of vermicomposting proved to have several benefits over regular composting, which must be considered when choosing alternatives for composting facilities in the future. The worms composted organic material very efficiently, and were able to effectively process waste on site. There are both economic and environmental benefits associated with this, as it diminishes the need to transport compostable materials off site. In addition to this, the soil which is a by-product of vermicomposting is extremely rich in nutrients. If vermicomposting practices were expanded at Dalhousie University, the soil which is produced could be used in gardens around campus.

Finally, vermicomposting can be used as an educational tool. People exposed to vermicomposting bins will learn about conventional composting, and the functioning of biological systems. Above all, it will foster a respect for the practice of composting and, hopefully, will help to make the campus a move towards being more sustainable.

This project has revealed that compost facilities in the LSC are inadequate. While the facilities in the LSC may technically comply with standards, it is not a true measure of success. Since the majority of students and faculty who use the LSC perceive the facilities to be insufficient, it is recommended that the accessibility of compost bins in the LSC be improved. This will include increasing the number of bins in the building, as well as placing them more strategically. This is an

important point, as having more composting bins does not necessarily solve the problem. The bins need to be place in areas where food consumption occurs.

In conclusion the research team would like to make a recommendation for a potential expansion of this project. Perhaps a team in the future could embark upon a project aimed at setting up more vermicomposters in offices and student lounges. A future research group from another ENVS 3502 class or other interested parties could also assess people's willingness to pay for vermicomposting systems, complete with a worm bin and information package, for their homes or offices. It is believed, due to the interest generated by this project that, if done correctly and on a small scale, vermicomposting could transform waste disposal habits in the Life Sciences Centre.

7.0 References

California Integrated Waste Management Board (1995). Pilot Worm Bin Project. Last viewed February 7, 2005.

"Canada's First Waste Reduction Week Kicks Off." (Oct. 15, 2001). CBC News. Retrieved from: <www.cbc.ca/story/news/national/2001/10> Feb. 3, 2005.

Christian, J., J. Joynt, R. Kennedy, K. McEachern. (1994).Implementation of Vermicomposting in Selected Offices on Campus.Unpublished WATgreen Project. Waterloo: University of Waterloo. <http://www.adm.uwaterloo.ca/infowast/watgreenprojects/projects_records/700.html> Last viewed February 7, 2005.

Cochran, S. (2004). >Resource Guide: Vermicomposting-composting with worms. University of Nebraska Lancaster County <http://lancaster.unl.edu/enviro/pest/factsheets/107-97.htm> Last viewed February 7, 2004)

Cochran, Soni. (2004). Vermicomposting - Composting With Worms!. Insects, Spiders, Mice and More. Retrieved from: <http://lancaster.unl.edu/enviro/pest/factsheets/107-97.htm> Last Viewed February 4, 2005.

Compostable Materials." (2005). Edmonton: Environment. <www.edmonton.ca/portal/server.pt/ gateway/PTARGS_0_2_271_213_0_43/http%3B?CMSServer/COEWeb/environment+waste+and+recycling/composting/backyard+composting/Compostable+Materials.htm> Retrieved January 31, 2005

Edwards, C.A. and Bohlen, P.J.. Biology and Ecology of Earthworms. 1996.

Edwards, C.A. and Lofty, J.R. 1972. Biology of Earthworms.

Elcock, Gillian and Martens, Josie(1995). Composting With Red Wriggler Worms. City Farmers: 1995.

Environment Canada (2002).Centralized composting helping to complete the carbon cycle' , <http://www.atl.ec.gc.ca/udo/carbon.html> Last viewed February 7, 2005

Eyers, J., Guitard M., Hambly R., Larion M. (1998) 'Vermicomposting on University of Waterloo Campus'. Unpublished WATgreen project: Waterloo: University of Waterloo.<http://www.adm.uwaterloo.ca/infowast/watgreen/projects/project_records/vermi.html> Last viewed February 7, 2005.

"Glossary of Terms." (1999). The Biosolids Lifecycle - Virginia Department of Health. Retrieved from: <www.biosolids.state.va.us/index.html> Feb. 2, 2005.

Kay, Paul. "Greening the Campus and the Community." (2004). The University of Waterloo. Retrieved from: <www.fes.uwaterloo.ca/ers/undergraduate/courses/ERS%20250F04.pdf> Feb. 4, 2005.

Merriam-Webster Online Dictionary. (2005). Merriam-Webster Incorporated. Retrieved from: <www.m-w.com/cgi-bin/dictionary> Feb. 3, 2005.

Palys, T.S. (2003). Research decisions: Quantitative and Qualitative Perspectives. (Third Edition) Thomson Canada Ltd. Scarborough Ontario, Canada .

Unknown (2002) 'Vermicomposting in Student Residences'. Unpublished WATgreen project, Waterloo: University of Waterloo. < http://www.adm.uwaterloo.ca/infowast/watgreen/projects/library/w02vermi.html> Last viewed February 7, 2005.

Unknown (2005) 'Vermiculture systems' Copyright of Composters.com < http://www.composters.com/docs/worms.html> Last viewed February 7, 2005.

Weed, R. (2003). 'Pilot Study: Initial Results For Vermicomposting Yard Waste with Biosolids for Mansfield Borough, Tioga County'. Pennsylvania Department of Environmental Protection. < http://www.dep.state.pa.us/dep/deputate/airwaste/wm/RECYCLE/ Tech_Rpts/Mansfield.htm> Last viewed February 7, 2005.

"White Paper on Environmental Management Policy." Department of Environmental Affairs and Tourism. July, 1997. Retreived from:<www.polity.org.za/html/govdocs/white_ papers/envir.html?rebookmark=1> Feb. 4, 2005.

8.0 Appendices

Appendix A
Literature Review

- **1.1 Introduction**
- **Case Study Reviews:**
    - **1.2 Environmental Studies**
    - **1.3 Educational Studies**

1.1 Introduction

A review of literature is an important aspect of performing any form of qualitative or quantitative research, as it provides a starting point for research questions and an adequate knowledge base with regards to vermicomposting. It can also help a researcher determine what methods or approaches work best and which should be avoided (Palys, 2003). This section will first provide an overview of the studies being reviewed and will discuss if the study provides a solution to the problem, rationale and objections of the project and whether it indicates past theories or projects from which it is based.

1.2 Environmental Studies

The first environmental study examined is a project performed by unknown students at Waterloo University in 2002 entitled, "Vermicomposting in Student Residences". The following is a summary of this study's objectives, methodology and final conclusions/recommendations:

Purpose and Objectives:

- To assess the feasibility of vermicomposting in a particular residence at the University of Waterloo by using both qualitative and quantitative methods.
- To reduce the amount of organic material being sent to the Regional landfill (and in doing so reduce the cost of waste removal for the University).
- To educate students, staff and faculty with regards to the benefits of composting.

Methodology:

- Familiarize researchers with the process of using vermicomposting by using the method of composting in their homes.

- Mail out surveys were taken to the specific residence participating in the study and interviews were done with key informants.

- Key informants were faculty and staff at the University and they were chosen because of their previous background with respect to vermicomposting.

Conclusions:

- Vermicomposting is a method of reducing the amount of waste going to landfills in the local area (however this wasn't quantitatively measured) and it addresses the social, economic and environmental aspects of sustainability.

- By educating the students, faculty and staff on campus of the benefits of composting, the researchers believed that vermicomposting is a feasible operation at the University of Waterloo however, it may take some time to get started on campus.

In reviewing this study, it was found that issues or problems being addressed were not clearly stated. However, solutions to the various vermicomposting problems were addressed clearly. Past studies from which this project was based were all stated but not discussed in a large amount of detail. Also it was not clearly indicated what aspects of a particular study were drawn upon during the creation of this project. It was found that some of the website references didn't exist and follow up research was impossible.

The objectives of this study were clearly stated and rational behind why this project was important was also included. Overall, this was a good project and it provided a good base for our study to start from. The objectives of the study were clearly met and the feasibility of compositing in a Waterloo residence was accessed.

Christian *et al* performed the next environmentally oriented study on the University of Waterloo Campus in 1994. It is titled "Implementation of Vermicomposting in Selected Offices on Campus". The following is a summary of the study's objectives, methodology and final conclusions/recommendations.

Objectives:

- To reduce the organic food component of the waste stream, by vermicomposting in selected offices on campus and attempting to achieve a high degree of participation/ awareness of composting techniques.

- To describe the project procedure so that others can easily implement a similar project or follow up on short and long term recommendations.

Rationale:

- Vermicomposting is a step towards a sustainable campus because it reduces waste going to the landfill and benefits are immediate and observable as it deals with waste at its source and it is easy and simple to do.

- Organic material comprises a significant amount of waste leaving the University Campus and by centralizing composting on campus a significant amount of waste is diverted.

Methodology:

- A questionnaire was prepared by the project team to be distributed to those individuals in the offices who had participated either in the decision making process of having a vermicomposter or any other aspect with relation to the vermicomposter.

- Visual Aids such as posters and handouts were created to help educate the students, faculty and staff at the University.

Conclusions:

- Vermicomposting has proven to be a success so far in its implementation on campus.

- It was designed to be sustainable within the campus system and therefore meet the mandate of the research team.

- It is recommended that a quantitative study is conducted on the composters already implemented (measuring food waste consumed, soil produced etc.)

In reviewing this study the problem is clearly stated and the study provides vermicomposting as a possible solution. Other solutions are not discussed but recommendations for improvements on this study are included. The researchers included some studies produced by other University of Waterloo students that discussed the amount of organic waste entering the local landfill however no

comprehensive or extensive report was given. Objectives and rationale for the project are clearly stated and the study was written with reference to its objectives.

The next study comes from the Pennsylvania Department of Environmental Protection and it was conducted by Weed in 2003. The study is titled "Pilot Study: Initial Results for Vermicomposting Yard Waste with Biosolids for Mansfield Borough, Tioga County". The following is a summary of the study's purpose, methodology and final conclusions/recommendations:

Purpose:

- To divert organic residuals from leaf collection and yard waste from the landfill
- Current leaf and yard waste disposal is ineffective yielding non-usable soil. The project proposes to assess different combinations of biosolids and leaf material for the highest quality soil produced.

Methodology:

- Quantitatively based data collection with members of staff producing the vermicomposting bins and caring for the worms.
- Parameters studied include: Bin temperature, %moisture, %Oxygen, pH, Salinity, if ammonia was detected, and if rot was detected. Measurements were taken once a week.

Conclusions/Recommendations:

- The combination of leaf compost and biosolids provided the most suitable environment for worm growth and produced the most castings.
- Bin temperatures should range from 40-90 degrees F, Moisture from 70-90 %, Oxygen from 5-15 %, pH from 5-9 and there must be low ammonia and salt concentrations.
- Larger bin size would provide enough time and space for worm hatchlings to crawl upwards towards the fresh waste.

Over all this study proved to be very insightful when dealing with the specific parameters required for idea worm environment. This pilot project did provide solutions to the initial problem and made a few recommendations to improve the project. There was no mention of past theory on which

this study was based and no reference section was included. Neither the rationale for the problem nor the objectives were discussed.

The final environmentally based pilot project is entitled "Pilot Worm Bin Project" and it was produced in 1995 by the California Integrated Waste Management Board. The following are excerpts taken from this study as a summary of the study's purpose, methodology and final conclusions:

Purpose:

- To reduce the amount of food waste entering the disposal stream in the California Integrated Waste Management Boards offices.
- To determine if worm composting (vermicomposting) is a beneficial method for diverting those scraps

Methodology:

- Qualitative results as the bin managers didn't record the information asked
- Mostly interviews were performed with the bin managers and the project manager.

Conclusions:

- The worms consumed a variety of food and ate most but not all of the staffs' food scraps. Costs were low.
- The worms had a positive presence for staff and the public with the time spent managing the bins being negligible.
- There were no odors or mess associated with the bins and shredded newspaper was more successful than soil for an assessment of worm casting production.

This study did not provide solutions to the problem of reducing the amount of waste entering the disposal stream in the California Integrated Waste Management Boards offices. Other conclusions were made but there appeared to be no measurement how the reduction in garbage being sent to the landfill. Past theory from which the study was not included but some of the staff had experience with the vermicomposters at home and care and feeding instructions were given by the local worm farmer. The rationale for the project was given but the study was not written with reference to its objectives.

1.3 Educational Studies

The first strictly educationally oriented study to be examined was produced in 1998 at Waterloo University and it is entitled "The Vermi-Campaign" (Eyers *et al*. 1998). The following is a summary of the study's purpose, methodology and final conclusions:

Purpose:

- To help the University of Waterloo to move towards a more sustainable Campus and to evaluate the use of educational tools to increase the success of vermicomposting throughout offices.

- The primary goal of this project was to create awareness on vermicomposting and to implement a successful vermicomposting program in University offices.

Methodology:

- The study was implemented by interviewing people who currently use, have used or would like to use a vermicomposter and eventually having three test subjects that looked after a vermicomposter in their office.

- Each subject was equipped with the necessary materials for the composter and educational materials created by the students

Conclusions:

- Educational information combined with weekly monitoring of the vermicomposters contributed greatly to their success

- They felt that 'a vermicomposting program should be established on campus with the purpose of being a 'help desk' for vermicomposters' (Eyers et al.,2004).

In this particular study the solutions to the problem were only mildly addressed. The students identified the problem as being a lack of knowledge about composting however, education/information was only provided to the three test subjects. The project was only loosely based on another study done at the University pertaining to the implementation of vermicomposting in selected offices on campus (Christian et al.,1994). A significant amount of supplementary information was used to help explain concepts and trouble shooting when it comes to vermicomposting. The

rationale and objectives of the project were clearly stated with the main objective of the project being to increase vermicomposting awareness and encourage personal responsibility by providing an interactive way to contribute to the environment on an individual scale.

Appendix B
Vermicomposting Questionnaire

Vermicomposting Survey for ENVS 3502 March 2005

Vermicomposting or worm composting is the process by which red wiggler worms are used to aid in the decomposition of organic material. As a by-product of the process, fertile soil is produced that can be used in gardens and for potted plants. This process reduces waste going to municipal landfill sites and composting facilities. We are requesting your participation in this survey so we can analyze current composting regimes practiced by students', staff, and faculty of Dalhousie University. We thank you in advance for your time!

I fully understand the project in which I am participating, and any information that I divulge can be used by the members of the Vermicomposting Pilot Project Group and in subsequent reports. I also fully understand that any information I discuss will be said without a guarantee of confidentiality/anonymity unless explicitly requested. Please sign on the line to show that you understand what you have read:

_____ _____
(Signature of participant) (Date)

If you have any questions or concerns about this project please contact:
- Alexi Baccardax - adbaccar@dal.ca (Project member)
- Dr. Tarah Wright - Tarah.Wright@Dal.Ca (ENVS 3502 Professor)

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1. What year and program are you in?_____
   Year Program (i.e. B.Sc or B.A and Department)
2. How would you rate your environmental awareness on a scale of 0-5 where 5 is very aware of environmental issues and 0 is totally unaware of environmental issues. Please Circle one
   0 1 2 3 4 5
3. Have you heard of vermicomposting (worm composting) before?
   a) Yes
   b) No -> Please go to Question # 5
4. If yes, have you previously used vermicomposting (worm composting) before?
   a) Yes
   b) No
   *If yes in what function have you used it? _____
5. Do you think that composting is important? And Why?
   a) Yes
   b) No

* Please Explain: _____
_____

6. Do you think the Life Sciences Centre (LSC) has adequate composting collection bins?
   a) Yes
   b) No
   * Please explain: _____
   _____
7. Do you compost while at the LSC?
   a) Yes
   b) No -> Please go to Question # 9
8. How often do you compost on average in the LSC?
   a) 1-4 times a week
   b) 5-9 times a week
   c) 10-14 times a week
   d) 15 + times a week
9. What if anything prevents you from composting while in the LSC?
   a) Not enough compost bins close to where my classes are
   b) Not interested, I don't normally compost
   c) Not enough time to find a bin
   d) Other _____
10. In what areas of the LSC have you composted in?
    a) Food court (Pizza Pizza, Manchu Wok and The Grill)
    b) Main stairs between 2nd and 3rd floor (By Tim Horton's).
    c) Within a department, please indicate which one _____
    d) Other _____
    e) None of the above
11. Would you compost more in the LSC if there were more composting collection bins available?
    a) Yes
    b) No
    c) Unsure
12. Do you compost at home?
    a) Yes
    b) No
    * If yes why? _____
    * If no why not? _____

13. How far would you walk to compost an item rather then deposit organic waste in a regular garbage can? (Please circle all that apply to you.)
    a) I would not walk further than the garbage can
    b) I would take it to another building if I couldn't find a recycling station.
    c) I would carry it with me until I passed by a recycling station, or take it home to compost.
    d) I would take it to another floor of the building that I am in to compost.
    e) I would take it to another room on the floor that I am on to compost.
    f) Other. You would: _____
14. Do you think the food services in the LSC do an adequate job to promote the separation of organic waste?
    a) Yes
    b) No
    c) Don't know

15. Where would you like to see a vermicomposting (worm composting) station set up in the LSC?
    a) In one of the wings (departments), if yes indicate which one: _____
    b) In a public area where it can be viewed i.e. in the common area.
    c) I don't wish to see stations set up
    d) Other:_____
16. If a vermicomposting pilot project was set up in one of the wings of the LSC would you like the idea of it being in:
    a) A student lounge
    b) A lab
    c) A hall way
    d) The museum in the Biology wing
    e) Other: _____
17. A vermicomposting project in the LSC is _____. (Please fill in the adjective, you can choose more than one.)
    a) Gross!
    b) A bad idea
    c) A good idea
    d) Necessary
    e) Other: _____

Feel free to add any comments or justification for you answer:

Thank you for your time!!!

Appendix C:
Additional Interview questions posed to Mike Murphy and Gary Gaudet

Additional questions asked of Mike Murphy:

1. Do you see a problem with offices in the LSC adopting vermicomposting bins that they take care of themselves?
2. Do you think Dalhousie would ever take on a large scale vermicomposting project
3. What do you think are the biggest reasons why people don't use composting bins?
4. What is the best way to combat this?
5. When do you plan to put extra bins in the LSC?
6. A small scale worm composting project in the LSC is _____ (adjective)
7. How much compostable material is generated on campus?
8. How many green bins or recycling stations are on campus?
9. Have you already received an invitation to the end of the year presentations?

Additional Questions asked of Gary Gaudet:

1. Do you see a problem with offices in the LSC adopting vermicomposting bins that t they take care of themselves?
2. Do you think Dalhousie would ever take on a large scale vermicomposting project
3. What do you think are the biggest reasons why people don't use composting bins?
4. What is the best way to combat this?
5. Will the addition of more OMG containers help this situation?

Appendix D
Consent Form for Personal Interviews

To Whom It May Concern;

I fully understand the project in which I am participating, and that any information that I divulge can **only** be used by the members of the Vermicomposting Pilot Project Group. I also fully understand that any information I discuss will be said without confidentiality/anonymity unless requested.

_____	_____
Signature of Participant	Signature of Researcher
_____	_____
Please Print Your Name	Printed Name of Researcher
_____	_____
Date	Date

Appendix E
Material Fed to the Red Wigglers
Over the Month Long Vermicomposting Pilot Project

March 3rd
Bin #1: grass, banana peel
Bin #2: pizza, grass, bit of a cookie

March 7th
Bin #1: ½ a bagel, 3 napkins, 1 tea bag, 2 coffee filters, 5 egg shells
Bin #2: took out pizza because it was moldy, did not add any more food.

March 9th
Bin #1: banana peel, apple core, piece of brown paper towel
Bin #2: banana peel, apple core

March 11th
Bin #1: Granny smith apple, red apple
Bin #2: Granny smith apple, small piece of celery, apple core, small pieces of paper Towel

March 14th
Bin #1: Banana peel, apple core
Bin #2: ¼ peanut butter sandwich, banana peel

March 15th
Bin #1: egg shell, apple core, banana peel
Bin #2: egg shell, apple core, 2 muffin cups

March 16th
Bin #1: Coffee filter and grounds, egg shell, 2 apple cores
** killed one fruit fly**
Bin #2: Banana peel, apple core, egg shell
** saw one fruit fly**

March 17th
Bin #1: 2 apple cores, 2 egg shells, 1 coffee filter with grounds, rice
Bin #2: Apple core, 2 coffee filters full of grounds
saw one fruit fly

March 18th
Bin #1: egg shell, 2 banana peels
Bin #2: egg shell, banana peel, apple core

March 21st
Bin #1: banana peel, tea bag, 2 egg shells, 1 bran muffin
Bin #2: 2 large apple cores, 1 bran muffin
** saw two fruit files **

March 22nd
Bin #1: 2 coffee filters and grounds, 2 apple cores, 1 banana peel

March 23rd
Bin #1: Full banana (old)
Bin #2: 3 coffee filters, ½ peach, small piece of bread, ½ green apple

March 24th:
Bin #1: Banana peel, piece of paper towel, coffee grounds and filter, grape seeds
Bin #2: Banana peel, coffee grounds and filter

March 28th
Bin #1: Banana peel, 2 large apple cores
Bin #2: Napkin, coffee grounds and filter, apple core

March 29th
Bin #1: 2 egg shells, 2 apple cores
Bin #2: 1 coffee filter and grounds, 2 banana peels

March 31st
Bin #1: 2 kiwi rinds, banana, 2 apple cores, 2 egg shells
Bin #2: sweet potato rind, kiwi rind, 3 banana peels, apple core

April 1st
Bin #1: 4 bana peels, 3 small napkins, apple core
Bin #2: Rice, small amount of curry rice, 4 egg shells, 2 banana peels

April 4th
Bin #1: coffee filter and grounds, 2 apple cores
Bin #2: 2 banana peels

April 3rd
Bin #2: 1 coffee filter and grinds, 4 banana peel, 1 apple core

April 6th
Bin #1: 3 bananas, 3 apple cores, 1 napkin, 1 tea bag, coffee grounds and filter

Appendix F
Data From
Student Questionnaires

STUDENTS RESULTS

235 surveys counted, some don't add up to 235 because of error or no answers

Q2: Students rate themselves environmental aware an average of 3.5 on a scale of 0-5
5--29-12.5%
4--90-39 %
3--88-37.9%
2--15-6.5%
1--7-3%
0--3-1.3%

Q3: Have you heard of vermicomposting before?
Yes: 153- 66%
No: 79- 34%

Q4: Out of the153 students that heard of vermicomposting, have they previously used vermicomposting before?
Yes: 35- 23%
No: 120- 77%

Q5: Do you think that composting is important?
Yes: 227- 98.7%
No: 3- 1.3%

Q6: Do you think the LSC has adequate compost collection bins?
Yes: 64-63%
No: 146-27.7%
Unsure: 21-9.0%

Q7: How many students compost while at the LSC?
Yes: 90-39.6 %
No: 137-60.4%

Q8: Out of 90 students that compost at the LSC, how often do they compost on average.
1-4 times a week: 88-98%
10-14 times a week: 2-2%

Q9: What prevents students from composting in the LSC?
Not enough compost bins close to where my classes are- 70 students-33.8%
Not interested, they don't normally compost -14-6.8%
Not enough time to find a bin – 43–20.8%
Other- 80- 38.6%

Q10: In what areas of the LSC have you composted in?
Food court- 45 students- 20.4%
Main stairs- 59- 27%
Within department- 13- 5.9%
Other- 4- 1.8%
None-100-45%

Q11: Would students compost more in the LSC if there were more composting bins available?
Yes: 130-59%
No: 29-13%
Unsure: 60-27%

Q12: Do students compost at home?
Yes: 167-72.6%
No: 63-27.4%

Q13: How far would students walk to compost?
Not walk further then the garbage can-54-24%
Take it to another building-13-5.8%
Carry it with me or take it home-68-30%
Take it to another floor-28-12%
Another room-54-24%
Other-8-3.6%

Q14: Do students think food service in the LSC do an adequate job to promote separation of organic waste?
Yes: 44-19% ; No: 84-36.5%; Unsure: 102-44.3%

Q15: Where would students like to see vermicomposting set up?
In one of the wings: 28-12.6%
In a public area: 155-69.8%
I don't want any stations set up: 16-7.2%
Other: 23-10%

Q16: If vermicomposting was set up in the wings of the LSC it should be in:
A student lounge: 27-11.8%
A lab: 25-10.9%
A hall way: 100-43.7%
The museum in the biology wing: 57-24.9%
Other: 20-8.7%

Q17: Students think vermicomposting in the LSC is:
Gross: 4-1.7%
A bad idea: 5-2.2%
A good idea: 187-81.3%
Necessary: 22-9.6%
Other: 13-5.7%

Appendix G
Pertinent Information From Faculty Questionnaires

FACULTY RESULTS

6 surveys counted

Q2: Faculty rate themselves environmental aware an average of 4.5 on a scale of 0-5

Q3: Have you heard of vermicomposting before?
Yes: 5-83%
No: 1- 17%

Q4: Out of the 5 Faculty that heard of vermicomposting, have they previously used vermicomposting before?
Yes: 2-40%
No: 3- 60%

Q5: Do you think that composting is important?
Yes: 6- 100%

Q6: Do you think the LSC has adequate compost collection bins?
Yes: 1- 17%
No: 5- 83%

Q7: How many Faculty members compost while at the LSC?
Yes: 2- 40%
No: 4-60%

Q8: Out of 2 Faculty members that compost at the LSC, how often do they compost on average.
1-4 times a week: 1-50%
10-14 times a week: 1-50%

Q9: What prevents Faculty members from composting in the LSC?
Not enough compost bins close to where my office is- 3-60%
Not interested, they don't normally compost -0
Not enough time to find a bin – 0
Other- 2-40%

Q10: In what areas of the LSC have you composted in?
Food court- 1- 20%
Main stairs- 0
Within department- 1- 20%
Other- 1
None-3- 60%

Q11: Would Faculty members' compost more in the LSC if there were more composting bins available?
Yes: 2- 40%
No: 1- 20%
Unsure: 2 -40%

Q12: Do Faculty compost at home?
Yes: 6 -100%
No: 0

Q13: How far would Faculty walk to compost?
Not walk further then the garbage can-0
Take it to another building-0
Carry it with me or take it home-0
Take it to another floor-2- 33%
Another room-3-50%
Other-1- 16%

Q14: Do Faculty think food service in the LSC do an adequate job to promote separation of organic waste?
Yes: 1- 16%
No: 3- 50%
Unsure: 2- 33%

Q15: Where would Faculty like to see vermicomposting set up?
In one of the wings: 2- 33%
In a public area: 4- 66%
I don't want any stations set up: 0
Other: 0

Q16: If vermicomposting was set up in the wings of the LSC it should be in:
A student lounge: 0
A lab: 0
A hall way: 3- 50%
The museum in the biology wing: 1- 16%
Other: 2- 33%

Q17: Faculty think that vermicomposting in the LSC is:
Gross: 0
A bad idea: 0
A good idea: 5- 83%
Necessary: 1-17%
Other: 0

Appendix H
Vermicomposting Ethics Approval Forms