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Modular Recreational Fishing Platform

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by

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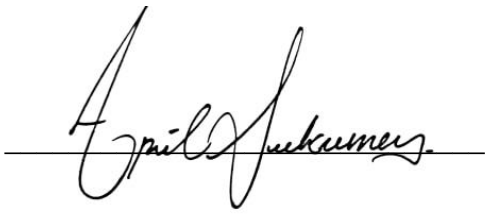
Signature : 

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Abstract

The traditional methods of water transportation used for recreational fishing have long been targeted towards expert anglers, singling out the selection of available products for the general public and fishing enthusiasts who rely on rental units. For the general public, these units accompany both environmental and human centered difficulties that affect one's experience and overall enjoyment such as no protection from harsh weather conditions, uncomfortable seating and limited space which often leads to mild or fatal injuries. The goal of this thesis proposal is to challenge the notion of existing transportation units, through an in-depth ergonomic study and analysis of current watercraft requirements, in order to enhance the recreational fishing experience for the general public and help to mitigate aquatic damage through advanced technological means. User research including interviews and observational studies will give detail and justify the design evolution in order to eliminate the current challenges faced by anglers. Additionally, with reference to existing platforms and boats, a one to one model will be developed in order to understand ergonomics and human scale as well as to evaluate the feasibility of the design. Results from this analysis will attain a design solution that expands the design possibilities for public fishing spaces, improve aquatic ecosystems and most importantly, help to provide a more relaxed experience for anglers by lessoning strains and hassles faced with current benchmarked solutions.

Acknowledgment

I would like to dedicate this to the memory of my father, Harnan Seekumar, who could not see this thesis completed but gave me the opportunity, knowledge and strength to pursue and accomplish my utmost desires and aspirations. I would also like to thank my mother, Oma Rasram, as this would not have been made possible without her ongoing support, advice and helping hand.

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1 Problem Definition

1.1 Problem Definition

Recreational fishing is a pastime hobby that is popularized and practiced by experienced anglers and fishing enthusiasts. Although entertaining, the current benchmarked products used for water travel within the sport causes inconveniences and injuries for the individuals who partake as well as aquatic damage and destruction caused to ecosystems. Limited space and mobility for angler's cause accidents such as being hooked and falling overboard the crafts (Salai, Blankstein, & Chechik, 2000). Strains with heavy anchors, limitations of fuel and no readily available access to bait are additional tedious issues that recreational fishing participants face when participating and trying to cover vast areas of water. In relation, fish stocks are continuously decreasing due to habitat destruction caused by the rise of lead levels in the water and chemical leaks caused by motors (Cooke & Cowx, 2004). In relation, the end goal is to enhance the recreational fishing experience by lessening the strain and injury caused to anglers and mitigate the damage caused to aquatic ecosystems.

1.2 Investigative Approach Taken

Within this thesis and with relation to the topic, information based on the benefits and disadvantages of current benchmarked products will be closely analyzed to understand what could be further developed within water transportation units for recreational fishers. Methodologies of the investigative approach will utilize qualitative and quantitative data collections, user input and advisor feedback on perceptions of fishing transportation units, upcoming trends and technology and systems that can be implemented in order to hypothesize a better solution for a water transportation unit geared for the use of recreational fishers.

Key Research Topics

- User experience (challenges & enjoyments)
- Current solutions
- User demographics
- Ergonomic interaction of boat spaces
- Safety regulations for water transportation units

Method of Solution

In order to develop a plausible solution to mitigate aquatic damage and recreational fishing strains, a multitude of research methods were used which include the following:

Category	Methodology
Research	○ Literature reviews and journal articles ○ Video analysis ○ User Interviews ○ User observation ○ Ergonomic studies
Data Analysis	○ Activity breakdown of videos, user observation and interviews ○ Analysis of benefits and features with regards to current benchmarked products ○ Aesthetic analysis ○ Ergonomic analysis of user interactions
Concept Exploration	○ Ideation sketching of new solutions ○ Concept development ○ Concept refinement
Scaled Model Development	○ CAD model development ○ Final model built to scale

Table 1 – Method of Solution

Key Questions

This thesis proposal and its investigative approach will be developed through key questions stated below.

- How may we enhance the recreational fishing experience through mitigation of user strains and help to aid aquatic damage?
- Is there an opportunity to develop a unit that utilizes natural organism and plantation systems in order to benefit the user and ecosystem?
- What are some of the features, or qualities not being considered by current benchmarked products?
- What are the opportunities of market potential for this solution and can they be expanded towards fisheries?

1.3 Background / History / Social Context

Recreational fishing is the practice of fishing for enjoyment or competition and is mainly categorized into sectors including freshwater fishing, saltwater fishing and fly fishing. In North America alone, the sport accompanied approximately over 49 million participants as of 2017, with freshwater fishing being most popular with a participation rate of approximately 38 million individuals (2018 special report on fishing, n.d.).

Demographically, individuals who participate in recreational fishing range from ages as low as 6 years of age to 69 years of age, men over 45 being the most prominent recreational fishing participants (2018 special report on fishing, n.d.). According to studies, adults often practice the sport in pairs or small groups of three which is accomplished on shorelines, boats and riverbanks with a perception of spending time with family, relaxing and connecting with the outdoors (2018 special report on fishing, n.d.).

The lifestyle trends amongst adult recreational fishing demographics, who are between 30 and 45 years of age, have an income between $75,000 to $100,000 and a high school education greater or equal to three years (2018 special report on fishing, n.d.). Their lifestyle trends while fishing involve participating in fishing trips between 1 and 11 times per year according to 2017 data statistics and engaging themselves in additional activities such as running, bicycling, hiking and camping when onshore. When offshore on crafts, they often engage in eating and harvesting fish depending on their involvement of catch and release habits of fish (2018 special report on fishing, n.d.).

Additionally, product trends include rod, reels and lines for general angling use and dinghy or speed boats as a source of water transportation method when trying to expand catch rates (cite 4). With relation to these benchmarked products, anglers face various challenges and inconveniences when practicing the sport and continue to amplify social problems such as water pollution, with the use of current benchmarked products.

This thesis is targeted towards finding a solution for freshwater recreational fishing within North America, primarily Canada, with a direct user group of expert anglers and fishing enthusiasts who are over 30 years old. Additionally, considering the user and social challenges, the data collection and methodology will aid to inform a plausible solution to these challenges.

2 Research

This chapter will focus on research gathered from users and existing product studies in order to answer and elaborate on the key questions concerning this project. Specific details will be directed towards current user practices, experiences and understanding ergonomics in order to better sought out the potential needs of targeted users and potential design prospects for the final solution.

2.1 User Research

2.1.1 User Profile/ Persona

Classification	Users
Primary User	General Public
Secondary User	Inexperienced Fishing Enthusiast
Tertiary User	Expert Sport Angler

Table 2 – User Profile/ Persona

Primary User: General Public

The tertiary user for this product is geared towards the general public which includes young and elderly individuals who participate in the sport, mostly through family outings or participate at low frequencies throughout the year. The general public includes semi-experienced and non- experienced anglers whose gear is preliminary starting gear as opposed to advanced and often resort to rental boats when in need of a water transportation unit.

Demographic Information:

Age:	6 - 29 years old
Gender:	Mixed gender
Income:	Plus / minus $24,000 or dependent
Education:	Mixed (native and foreign schooling)
Fishing Group Size:	Approximately 2 – 6 individuals

Secondary User: Inexperienced Fishing Enthusiast

The secondary user for this product would be geared towards inexperienced fishing enthusiasts who are individuals that primarily fish for leisure and do not necessarily partake in advanced sport fishing competitions. Fishing enthusiasts are semi-equipped in terms of their gear and fish using rentals products or advanced watercrafts.

Demographic Information:

Age:	30 – 44 years old
Gender:	Mixed gender
Income:	$25 – 50,000
Education:	Mixed (foreign and native schooling)
Fishing Group Size:	Approximately 2-4 individuals

Tertiary User: Expert Sport Angler

The primary user(s) of this product would be expert sport anglers who are high frequency participants and have a vast amount of experience with products that help them to trail waters, allowing them to target various fish species. These individuals tend to be older, more independent and are developed in terms of their gear usage, and essential needs when fishing. Expert sport anglers also engage in frequent competitions as opposed general leisurely fishing.

Demographic Information:

Age:	45 – 65 years old
Gender:	Mixed gender (mostly male)
Income:	$50 - $75,000 +
Education:	Mixed (foreign and native schooling)
Fishing Group Size:	Approximately 1 – 3 individuals

Demographic Summary

The following data was gathered from (Appendix II – User Research)

Demographics		Use Behavior		Personality		Cognitive aspect	
Age	40-65 <20	**Frequency of use**	Average of 13 times per year	**'locus of control'**	↑	**Technical Skill**	↑
Gender	Mostly male (~79%)	**Duration**	Between 5-7 hours per fishing trip	**Self-efficacy**	↑	**Pre-req. content knowledge**	--
Culture / Ethnicity	Predominantly Caucasian	**Social/Solitary**	Mixed	**Changeability**	--		
Income	<20 : low income 40-65: $50 - $75,000+	**Level of Focus**	40-65: High <20 low	**Uncertainty Avoidance**	--		
Educational Bkgd	Mixed between individuals (foreign and native schooling)	**Location**	(outdoors) Lakes, boats and shorelines				

Table 3 – Demographic Summary

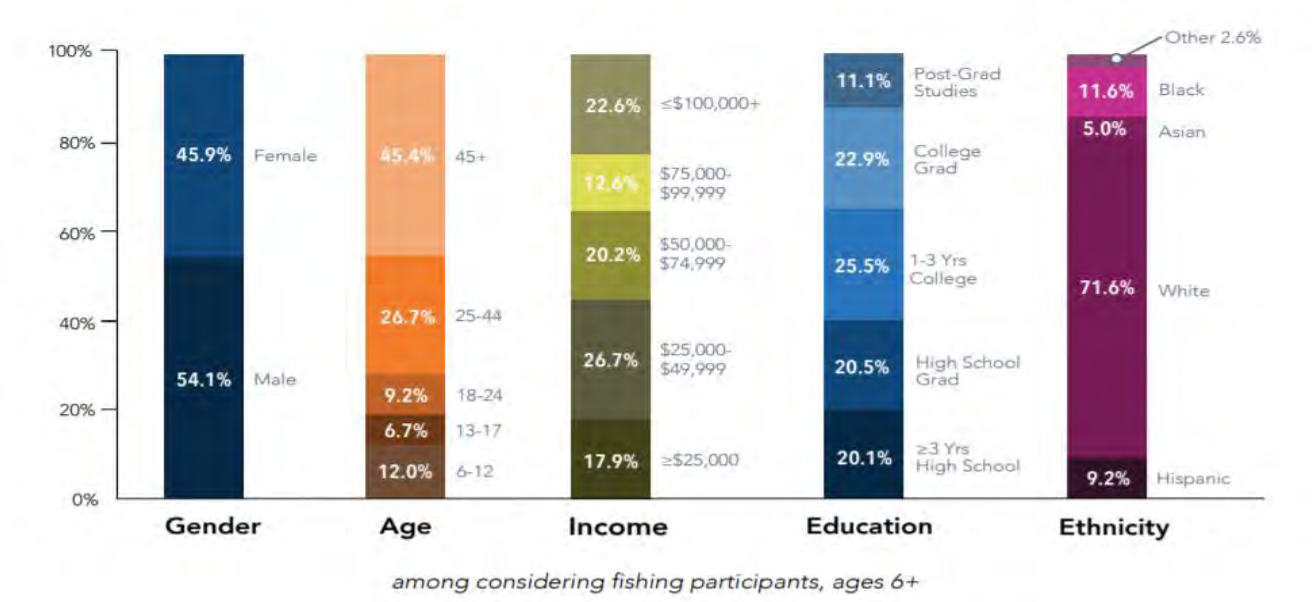


Figure 2-1, 2018 Special Report on Fishing, Considering Fishing Participants, USA, 2018

Overall, recreational anglers in North America, tend to be mixed groups of adults aged 45 – 65, although primarily male, with a high frequency of fishing while secondary and tertiary user groups are mixed individuals from age 6 to 44 with a medium to low frequency.

User Persona

Name:	Bob Bennet
Age	46
Job:	Industrial Design Prof.
Income:	$65,000
Education:	University graduate
Relationship:	Married
Location:	Toronto, ON
Main Hobby:	Recreational fishing
Frequency:	Late summer
Duration:	6 hours per trip
Social:	With friends & spouse
Other Pursuits:	Cooking & Gardening

Table 4 – User Persona

Figure 2-2. Real fishing magazine, Bob Izumi, Retrieved Nov 21, 2019 from https://realfishing.com/magazines/real-fishing-magazine-winter-2018/

Profile:

Bob Bennet is a 46-year-old Caucasian individual who has been teaching the study of Industrial Design for over 6 years. Bob has graduated from University with a PhD and is happily married for over 30 years to his wife. Fishing has been a long-time family outing for Bob since he was a child and has become more experienced with various fishing practices and tournaments over the years. As a high frequency participant, Bob actively joins fishing tournaments in Ontario and on his spare time partakes in hobbies such as cooking and gardening.

User Behavior:

Bob enjoys fishing with a group of 2-3 close friends, including his wife, they like to fish during the end of summer when waters are much cooler and fish sizes have increased. On average, Bob spends 6 hours fishing and tries to enjoy his hobby 12 times in a year.

Nonetheless, Bob owns a 14" tracker boat which allows him to cover waters in order to increase catch rates. He regularly buys tackle and rods, improving his style and fishing techniques. Bob usually enjoys Bass fishing around weedy shorelines, however, he occasionally practices fly fishing along riverbanks.

2.1.2 Current User Practice

The following data was gathered from (Appendix II – User Research)

User Behavior Summary

For recreational anglers, current fishing devices and water transportation methods are made available to aid various user practices and suit lifestyle behaviors including tracker boats and platforms, however, the usage and needs vary depending on the demographic range and categorization of the user and limit the users depending on the cost and accessibility of the item in terms of weather conditions or general popularity in usage.

Frequency

According to statistical research, the average yearly outings for recreational fishers within North America were approximately 18 outings per person in 2018 (2018 special report on fishing). However, with reference to personal data collections and user observational research appointed in section 2.1.3, the average outings are dependent on the user category, whether they be experienced, non-experienced or generalized recreational fishers. It can be guesstimated that while avid recreational fishers conduct up to 18 outings per year, fishing enthusiasts have a frequency of 6-8 outings per year and the general public partakes in a frequency of 5 or less fishing outings per year.

Duration

The duration of fishing trips for avid recreational fishers is between five to seven hours according to a 2005 statistical study and summation of user data collections (2005 Survey of recreational fishing in Canada, 2009). This number varied depending on whether individuals were residents within North America or were nonresidential individuals who visit and fish occasionally within North America (2005 Survey of recreational fishing in Canada, 2009). These hours were also much higher when participants were on crafts (2005 Survey of recreational fishing in Canada, 2009).

Social or Solitary

With regards to recreational fishing, statistical studies show that the sport was a social activity and on average, individuals were accompanied by 2 – 3 individuals during their fishing trip, however, numbers vary depending on whether outings were family oriented or generated through sport fishing competitions (2018 special report on fishing, n.d.). User studies pointed in sections 2.1.3 of this thesis report also suggest that the statistical data was closely related, however, the group sizes for family outings varied from 3 to 6 individuals.

Motivation

The motivation for recreational fishing included spending time with family and spending time outdoors in order to get in touch with nature. A reported 73% of individuals in North America were motivated to spend time with family while 70.5% of North American individuals were motivated to spend time outdoors (2018 special report on fishing, n.d.).

Lifestyle

The lifestyle of primary, secondary and tertiary anglers varies depending on individuals, however, through an in-depth study of user behavior it is suggested that anglers live a conservative and active lifestyle depending on demographic considerations. Lifestyle trends while fishing evolved fishing trip between 1 – 18 times within the year that was also paired with additional activities such as hiking, camping, bicycling, and running (2018 special report on fishing, n.d.). The lifestyle trends of recreational fishers also included spending more time on boats with a utilization of 77% of individuals, whereas 23% of individuals chose not to use a craft (2005, survey of recreational fishing in Canada, 2019).

Focus and Exertion

In terms of recreational fishing, the focus and exertion are low. Some focus and exertion are given when operating crafts and practicing cast and retrieve methods. Overall, the general practice has a low exertion and focus.

Location

In terms of recreational fishing locations, the most popularized areas for anglers are around shorelines and riverbanks (2018 special report on fishing, n.d.). Indirect locations include fishing from a boat or Kayak while exploring areas of lakes or nearby waterways; this information is focused on and limited to studies conducted within North America, however, additional fishing locations include public docks and rocky coastal areas as referenced from the user observation further shown in section 2.1.3.

Purchasing Behavior

In order to understand the purchasing behavior of recreational anglers, income levels and spending habits through task studies were sought out. Anglers who fit within the

demographic category of 45 - 65 years of age have an approximate income of $50,000 - $75,000 and on regular purchase advanced tackle gear including rods, baits, line, fishing apparel including boots or pants and also invest on personal water transportation crafts to avoid rental solutions. Fishing enthusiasts and the general public sit below the $50,000 income margin and own preliminary tackle and rods; there purchasing behavior also includes supporting rental units from available fisheries.

2.1.3 Activity Mapping

The following data was gathered from (Appendix II – User Research)

In order to effectively understand the scope of user experiences and overall activity demeanors, multiple video analysis and a single direct user observation was conducted, documented and closely analyzed to better suggest potential areas of improvements and need factors for the primary, secondary users. This section will showcase two observational studies including an activity mapping through a single video analysis and a direct user observation.

User Observation 1 – Video Analysis

In this video analysis, a family of four is studied in order to understand the environmental considerations with the utilization of a fishing boat and study the overall demographic group that is involved with the sport.

STEP 1: Setting up the gear

- Individual male figure attempts to set up the gear on shore
- Individual feeds the line through the rod and attaches a hook along with bait

Figure 2- 3. User setting up gear

STEP 2: Entering the boat

- Man enters the boar in order to Set down robs and essential gear
- Man starts engine of the boat
- Three other individuals board the boat (1 child, 2 female adults)

Figure 2- 4. User entering boat

STEP 3: Casting and Waiting

- Individual woman casts the line
- All three individuals wait for A bite
- Individual is ready with a net

Figure 2- 5. User casting and waiting

STEP 4: Retrieval and netting

- Women lower nets and reel in the fish in order to succefully catch it

Figure 2-6, Women retrieving fish

STEP 5: Sail the waters

- Family sails the waters in order to cover more areas
- Casting away from direct weeds

Figure 2-7. Family sailing stream

STEP 6: Repeat steps 2 – 5 until dark

- Steps 2-5 are repeated until it is dark
- family uses a flashlight in the video to navigate the boat in the dark

Figure 2-8. User fishing in the night

STEP 7: Cook and eat fish on shore

- Family arrives back on shore, Cleans and cooks the fish for Dinner
- A campfire is made to enjoy The overall experience

Figure 2-9. Family conducting a campfire

User Observation 2 – Direct Observation

In this direct user observation, the habits of two individuals were studied on November 3rd, 2019 in the area of Barrie, Ontario. The limitations to the observational study and their overall experience include being able to fish only through the means of public docks due to poor weather conditions and boating troubles.

User & Activity Mapping

Name: Carlos. M
Age: 59
Sex: Male
Fishing Activity: Twice a month
Type: Dock Fishing

Name: Joseph. P
Age: 21
Sex: Male
Fishing Activity: Once a month
Type: Dock Fishing

STEP 1: Setting up the gear

- The angler organizes their gear which Includes fishing rods, and selected tackle that is attached to the rod
- Additional gear included tackle boxes filled with lures such as crank baits, soft baits and spoons
- Live baits were also bought in addition to tackle

Figure 2-10. User setting up fishing gear

STEP 2: Adding bait to the hooks

- Anglers added live worms to the hooks using their hands and with no glove utilization
- Comfortable clothing was worn to accommodate the weather during the season
- Anglers mentioned the hassle with Worm boxes flying away due to wind

Figure 2-11. User adding worm to hook

STEP 3: Finding a location

- Anglers looked for a location away away from the weeds and rocks to avoid their line from getting stuck
- Anglers expressed their feelings Of dock fishing and stated that dock fishing limits their ability to cover vast areas of water

Figure 2- 12. Searching for a location

STEP 4: Casting & waiting

- Anglers casted their lines into the water
- Wait time for bites were within 5 minutes intervals
- Anglers would recast within the 5-minute mark

Figure 2- 13. User casting his line

STEP 5: Retrieval & Occasional Fixing

- With an approximation of up to 15 to 20 cast, anglers would reel Their lines in and fix the gear

- Anglers often needed to fix the lines of any tangles and snags; this required a substantial amount of room in order to balance or stand the rods

Figure 2- 14. User fixing the line

Overall Observational Insight

User Observation 1 – Video Analysis:

Overall, the video analysis of the family fishing trip gives insight to the humanistic experience concerns that the family faced while fishing. The observational study also showcased techniques and tools that were used for the day to nighttime environment settings. Balance, stability and space restrictions were the most found issues in the video and it can be noted that around 27:03, the male adult struggles to enter the boat, even with it being stationed slightly on the shore. The family totaled up to 4 individuals; it was apparent that the boat was crowded, and movements were limited. Additionally, at 14:08 the setting of the environment changed from day to night which made it hard for the family to fish in the dark, however, they resulted in using a flashlight in order to navigate their way through the waters. The gender demographic was equal with 2 male individuals and 2 female individuals, most of which were adults approximately ages 28 to 50 years old. Additional information that was concluded from the video analysis was the usage of gear. The users had preliminary startup gear and did not wear any suggested clothing which would help to adapt to weather condition, it should be noted that the individuals were also not wearing a life jacket on board the boat.

User Observation 2 – Direct Observation:

After conducting the direct user study, multiple areas of concern were visualized and noted through conversations with the users. Although the study was limited to dock fishing, the users faced equal challenges to that of boat fishing such as poor weather conditions which influenced the overall enjoyment of fishing. The users had undergone hailing weather for the season of November and no cover or protection was available. Issues such as live bait boxes blowing away due to heavy winds were small, yet tedious user challenges and aside from the chronology of observation, other areas of study that are important to note include the users having to adapt to the poor weather conditions using garbage bags.



Figure 2- 15, 16 & 17. User in garbage bag, Broken boat, Dock during hailstorm

Potential Improvements

- Coverage from weather
- Providing stations with worms on local fishing docs or boats which can be easily stored and re-used by other anglers
- Opportunity to utilize the leftover worms in order to provide help with another system
- Stands or stations where individuals can fix their rod

2.1.4 Ergonomic Research

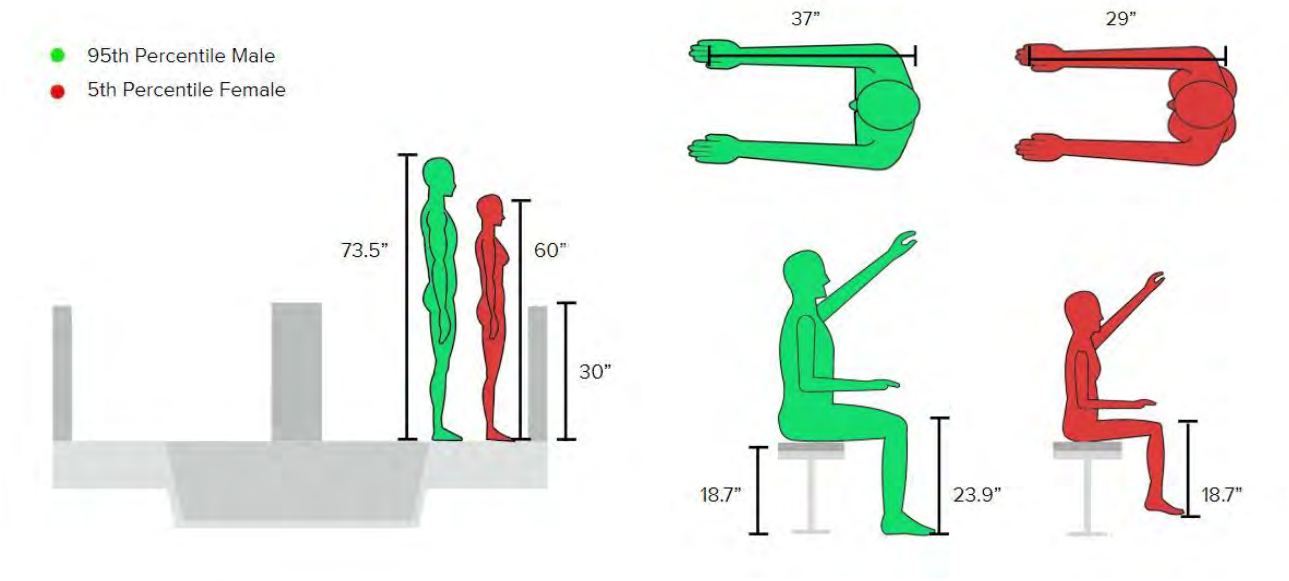


Figure 2-18. Top view Ergonomic evaluation of 95th male and 5th percentile female

Current benchmarked solutions that are in the market and often used by general fishing enthusiasts include pontoons and single user kayaks. The above drawings showcase an ergonomic evaluation of measurements that are seen in both items such as the seating and general barrier height for units, however, the above drawings do not reference a scaled image of current benchmarked product profiles and are conceptual profiles that have been modified with dimensions relevant in the market. For seating heights, the average single user seating is approximately 18.7 inches high, measured from the ground to the top of the seat. The barrier which acts as a protective shield, preventing anglers from falling over, is a standard height of 30 inches; this measurement is taken from the base of the structure to the top of the barrier. Some limitations of these units include no having enough space per person to accommodate a full arm span in case of various movements anglers may carry out while practicing the sport.

2.1.5 Safety & Health Research

Safety & Health Background Information

The sport of recreational fishing has an abundance of safety and health aspects that should be considered for general fishing users and individuals who partake in boat fishing. According to statistical studies documented in 2003, 9% out of 289 people drowned from a boat fishing accident; this number totals up to 27 people out of the 289 individuals (Lifesaving Society, 2016). These deaths have resulted from conducting in actives on a lake or pond and in terms of the boating incidents found within Canada, 82% of individuals were found without a life jacket; this number is totaled for all boating accidents, not solely boat fishing (Lifesaving Society, 2016). Amongst the most frequently used boating vessels, the use powerboats had the highest accident rate and the least being the use of personal watercrafts (Lifesaving Society, 2016). Additional demographic studies show that the demographic for drowning amongst recreational fishermen tend to be primarily male individuals ages 65 – 74 (Drowning in Canada, 2000). In terms of recreational fishing user accidents with regards to equipment, the most frequent accidents include penetrating fishing injuries and injuries caused by fishing rod hooks, harpoons and spears (Dudkiewicz, Salai, Blankstein & Chechik, 2000). Direct user data collections also suggest that injuries are due to stability issues of current benchmarked products.

Safety & Health Considerations

With reference to the above data collection, safety and health should be addressed and considered for user penetration and falls; some of which exist on current benchmarked products and are not limited to:

- Stability mechanism underneath craft
- Lights for visibility during nighttime settings

- User quick release that allows for a fast and safe hold if fallen overboard

In terms of lifejacket safety, this tool should be made available to user by the owner or provider of the craft and regardless of design iteration geared towards user safety and overall user consideration, the potential to remain safe through the use of a lifejacket is up to the individuals demand. Nonetheless considerations can be made for crafts according to regulations, kayaks should be used in a depth of 0.5ft of water, power boats should be used in a depth of 3ft of water and row or drift boats should be used in a depth of 1 ft of water; this information will give better insight to the overall and final dimensions of the solution, identified later in this thesis report (Hyra, 1978).

2.2 Product Research

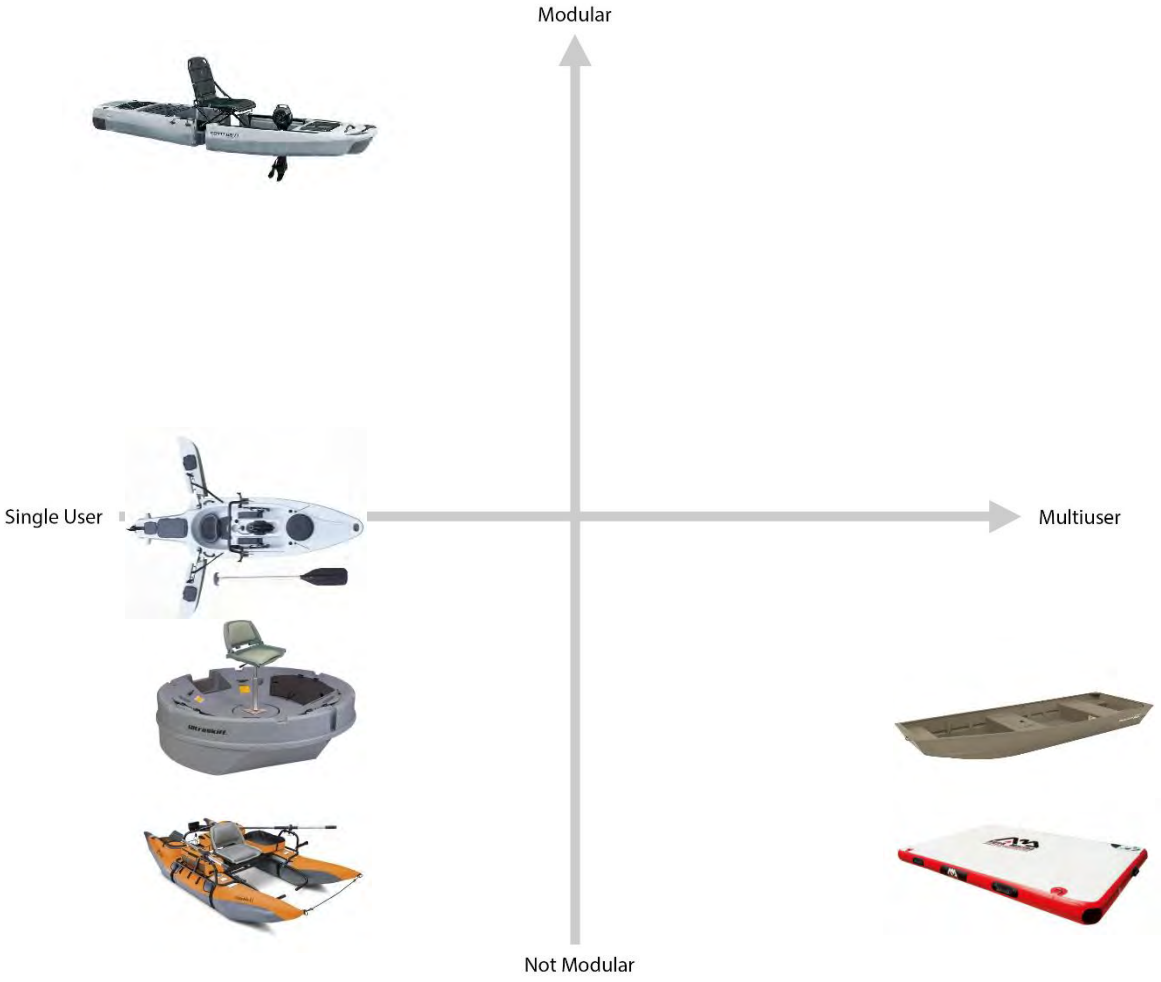
2.2.1 Benchmarking – Benefits & Features

This section examines six current benchmarked products that exist for recreational fishers in order to determine and understand the main benefits and features. The ends goal of this thesis report is to provide a more relaxed experience by lessoning strains and hassles for recreational fishers, as well as, make detailed considerations that could better mitigate the damage for aquatic ecosystems. The below products were chosen in accordance the needs of the primary and secondary user.

Products Compared – Fishing Crafts:

1. Ultraskiff 360
2. Fissot Kayak
3. Topper 1542
4. Colorado XT Pontoon Boat
5. Aqua Marina Island Floating Plate
6. King Fisher Modular Fishing Kayak

X-Y Graph



The above X-Y graph demonstrates an assumed insight that most benchmarked products are catered for single user experienced and suggests that there may be an opportunity with multiuser designs. Additionally, there is limited modularity with the above benchmarked products; this is also an area of exploration for further improvements.

Common Benefits & Features

The most common benefits and features of the above benchmarked products include durability, safety, stability and comfort. Although these benefits do not apply to all the above products, there is an overlapping in a variety which suggest a common benefit analysis. Common features include storage, seating, motors and rod holders. Considering these benefits and features, the most frequently used subjects can suggest possible outcomes for the design solution.

2.2.2 Benchmarking – Functionality

The functionality for the above benchmarked products are similar in terms of usage for the anglers; this includes their purpose of transporting through waters and having a system that allows for movement, however, some of the major differences between the products include, being able to operate the unit with a motor or more strength intensive methods such as paddling by hand or foot. The functionality of the products also varies in terms of single user or multi-user usage. The following list below will summarize these key findings, found amongst the analyzed products.

- Ability to navigate through water via motor or manually (not stationary)
- Multi-user or single user
- Storage spaces available for gear
- No safety belts or safety signals on the units
- The type of product utilized by individuals is dependent on the price (own their own boat or rent)

2.2.3 Benchmarking – Aesthetic and Semantic Profile

Aesthetic/symbolism

The general aesthetics for current benchmarked watercrafts, boats and platforms as iterated in section 2.2.1 under the X-Y graph shows the variations between single user designs and multiuser designs. The overall aesthetic of these products is geared towards single user use and although the overall elongated aesthetic may provide stability for anglers, there is a restriction in movement, activities and overall consideration towards user habits in relation and general experience. Currently, the designs of crafts are based on the functionality of the device floating moreover the functionality of the user's experience. More emphasis could be easily applied to simple user problems such as incorporating covers, utilizing different shapes to accommodate more people or perhaps have an element of modularity.

Form/Semantics

As mentioned above, form can be explored in a variety of ways in order to accommodate simple user problems. Most of the current shapes that exist for benchmarked crafts and platforms are elongated shapes with a squares profile that offer no room for other users and have single seating areas. The current elongated shape may symbolize speed or forward movement; however, shapes can become more appealing to users with rounded developments that add a feeling of movement for the viewer. The ability to develop form also gives opportunity to generate symbolism within the design through inspirations of nature, allowing anglers to connect with their product similarly to the way they connect with the outdoors. Additionally, the current material use, and price range are also semantics factors that can be understood as an engineered considered approach, offering stability and strength for the user. Overall, the current and most frequent features implemented such as seating with rod holder aspects, are driven through human factor considerations.

2.2.4 Benchmarking – Materials and Manufacturing

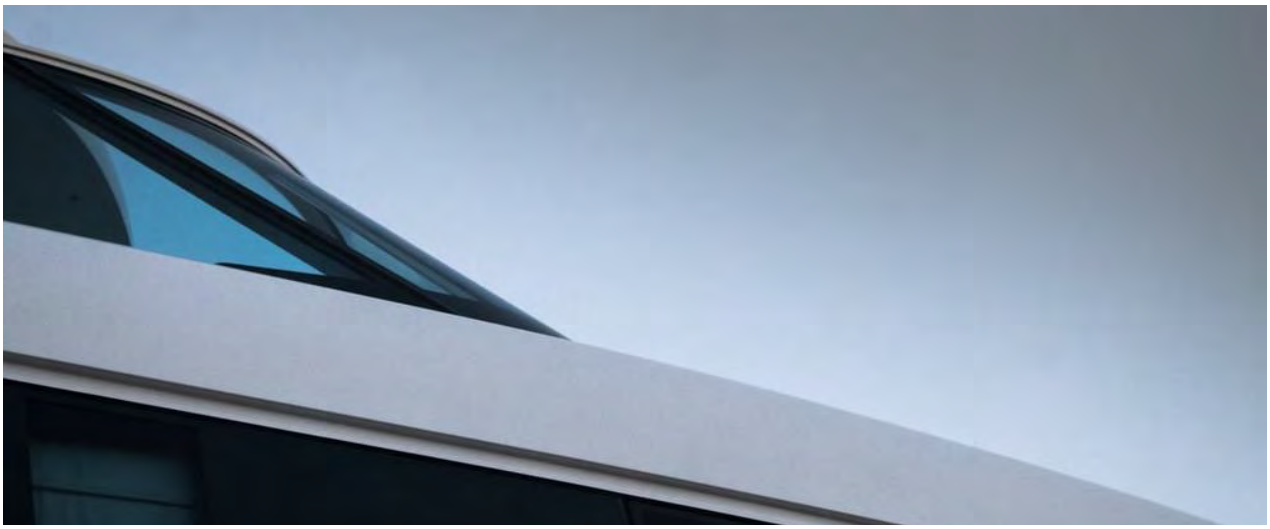


Figure 2-19. Treći, N. (2019). Cropped boat [Digital Image]. Retrieved from https://unsplash.com/photos/RVab6azxPXw

Materials Used

The method to which materials are considered for the following benchmarked products and water crafts in general are heavily dependent on their ability to stay afloat above the water, provide balance and being able to withstand factors such as weather, snags on rocks, algae from weeds and any contact it may endure during it's time outdoors. Softer fabrics are also used primarily for higher-end products that give the users a luxurious and finished feel. The most used materials found include:

- UV resistant Polyethylene or HDPE
- Abrasion Resistant PVC
- DWF Material
- Aluminum
- Felt and carpet (inlayed for a complete finish)

Manufacturing Methods Used

The manufacturing methods used for the benchmarked products and generalized watercrafts are dependent on the material that is utilized, whether it be plastic or metal. The following manufacturing methods have been compiled from the current products and are a determining scope which allows to understand how the overall forms have been developed.

- Rotational molding
- Blow molding
- Metal cutting and bending (This procedure takes place for aluminum boats, the parts are cut from metal sheets and bent around a wooden template as well as reinforced with rivets)

2.2.5 Benchmarking – Sustainability

With regards to sustainability, there has been some but little consideration to the end life of water transportation products. Products such as kayaks which are rotational molded units made of HDPE, have been recycled in order to develop a resin-based material that allows for the remake of additional kayaks (Farrow, Johnson & Larson, 2000). Additional concepts such as bladeless motors, utilize systems equivalent to that of a Dyson fan and have been developed in order to help mitigate aquatic damage and danger to aquatic species, an example of this can be seen in the boat blade by Yanko design. Although small considerations have been thought through, much larger benchmarked products such as aluminum boats end up in the scrap yard where the parts either get recycled for usage of other items or simply end up in landfills. On average an item like that of a Kayak has an expectancy of 12 to 15 years, while a speedboat may have a lifespan of up to 30 years (Farrow, Johnson & Larson, 2000).

3 Analysis

This section closely analyses the information collected in the above chapters, 1 and 2 in order to develop a thorough needs assessment for the primary, secondary and tertiary users of recreational fishing. The following sectors target the challenges, wants and needs of the users, to gear towards a plausible solution. This chapter will also make use of ergonomic studies such as user percentiles and measurements.

3.1 Needs Analysis

Based on the above chapters, the current needs statement is as follows: a modular water transportation unit that provides comfort and relaxation through the mitigation of user strains, while accommodating aquatic considerations that benefit the user and ecosystem.

3.1.1 Needs/Benefits Not Met by Current Products

In the current market, there are benchmarked products such as platforms, dinghy boats and kayaks that allow users to expand their fishing experience from the dock to the water and gives ample room for users to increase catch rates through travel and mobility. While many of the benefits include mobility on water, providing storage and safety, there has been little emphasis on practices such as optional user movements, allowing individuals to stand, sit or perhaps kneel. The needs and benefits that are not addressed also include simple user practices such as designing in such a way that allows the user and ecosystem to sustain through one another or is designed in an appealing manner that adapts to their surroundings, allowing for configuration of space and comfort. Additionally, there has been some considerations made for aquatic ecosystems, however, in terms of recreational fishing units, little innovation has been made for units to incorporate systems that aid in the cleanup of waterways for ecosystems to sustain. The current user needs, and benefits are as follows:

Needs	Benefits
Comfort	• Provided room and space for multiple or single users (sitting, standing, kneeling)
Safety	• Stable and does not tip easily when moving • Cover from weather conditions • Safety for uses by accommodating different weight aspects of users • Safe to use in different environments
Aesthetics	• Appealing and adapts to the users surrounding • Modularity for users
User Interaction	• Easily understood and provides equipment that can be accessed quickly • If made portable, ease of use of transporting
Environmental	• Addresses concern for aquatic life • Expands differences for user within a saturated market

Table 5 – User Needs & Benefits

3.1.2 Latent Needs

Benefits	Fundamental Human Needs	Relationship with Benefit
Comfort	Control, self-esteem	Strong
Aesthetics	Pleasing, self-esteem	Moderate
Safety	Security, autonomy	Strong
Ease of Use	Accomplishment, control, mastery	Strong
Fun	Leisure, excitement, participation, belonging	Strong

Table 6 – Latent Needs

Comfort

With recreational fishing watercrafts, the implementation of comfort is important since anglers can spend approximately 5 to 7 hours fishing on lakes or riverbanks. With added comfort, users will feel a sense of control and feelings of self- esteem.

Aesthetics

The aesthetics of a uniquely designed fishing watercraft can give users the sense of self-esteem through the overall aesthetic by allowing them to feel as if they stand out or fit in with other users, in terms of how current the design is in a social marketing context.

Safety

The safety for users with reference to fishing crafts allow them to feel secure and content since they are not worrisome over the prospect of being injured while practicing their sport. The relationship between the user and the overall safety element of the unit is critical, especially for recreational use.

Ease of Use

The aspects of the fishing unit whether they be motors, storage units or rod holders should be easy for the users to understand and operate, giving a sense of accomplishment to the user and feelings of good control.

Fun

In terms of fun, recreational fishing can be accomplished in groups or individually and should give. Overall, the aesthetic, controls, safety components and generalized design of the unit should allow users to feel excited about fishing and motivate them to practice their enjoyment regularly without doubts.

Figure 3-1 Maslow's Hierarchy of Needs

3.1.3 Categorization of Needs

The categorization of needs for the potential design is focused on mitigating current user problems including strains and tedious tasks that interfere with the overall relaxation and enjoyment of recreational fishing. The primary need factors will be better analyzed from information gathered through direct and non-direct user interviews and will aid to narrow the design focus for this thesis topic.

Wants

- A unit or product that provides shelter from weather
- Accessible bait units to eliminate the need of carrying extra boxes or bins
- Modularity for space and comfort

Immediate Needs

- Enhancing the recreational experience
- Implementing feelings of relaxation
- Providing accessibility for user needs such as baits, storage
- Generating user safety from weather

Latent needs

- Aesthetically appealing and approachable
- Provide feelings of security
- Intuitive for the user to emit feelings of good control and mastery
- Give freedom, and provide excitement and relaxation
- Connectivity with the outdoors

3.1.4 Needs analysis Diagram

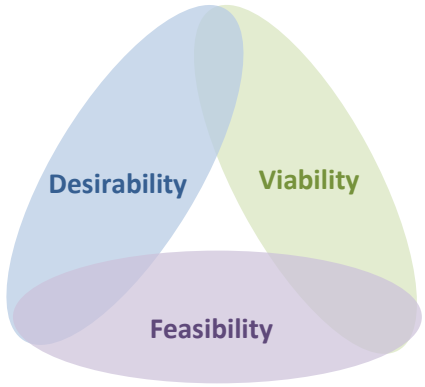


Figure 3-2. IDEO's Design Thinking Diagram

Desirability

For recreational anglers the desirability leads itself to mitigating user strains such as space accommodations, modularity, protection and aesthetics. Once these issues are better established, anglers will desire the opportunity to experience and try the developed unit, allowing for the chance to test the functionalities in comparison to the products that are normalized in the market.

Viability

The current market for recreational transportation units has not been expanded for the combination of user benefits and aquatic mitigation, as well as modularity. These aspects are

lacking in the market and there is opportunity to sustain the viability of the product by incorporating these elements in order to lead the future market and aid in developing solutions that will be better focused around user experience and aquatic cleanup.

Feasibility

For the enhanced recreational platform, there has been much development in the market in terms of technologies, systems that have been both developed and conceptualized; these developments can be considered in order to develop a feasible end product. The main challenge for this unit will be incorporating the elements in a way that has not been accomplished before such as the use of modularity of the overall unit an example being, allowing users the freedom to disengage the unit from one another. With the circumstances of water and how the unit reacts to the circumstances of movement, the feasibility of modular components may be a challenge for users and not the overall manufacturing aspect.

3.2 Functionality

In section 2.1.3, recreational fishing activities were observed through video analysis and direct user observations in order to get an in depth understanding of both dock and boat fishing and not limit the research possibilities to one sector. This section will thoroughly document and describe the key insights that were gathered through both observational studies, as stated below.

3.2.1 Activity/Workflow Mapping

Video Analysis

Observation 1:

The first observation made in the video analysis of the family fishing from a boat on the riverbank was the limitation of movements present and each individual had to take turns

entering and exiting the boat in order to make space; this was also taking place when the boat was stationed slightly on shore. This analysis can inform a design for the plausible solution through product modularity and makes possible the use of interconnecting forms. Adjustability with respect to form development is the possible design direction.

Observation 2:

The second observation from the video analysis includes the transition from daytime to nighttime recreational fishing. The users struggle to navigate their ways through the water and resulted in using a flashlight in order to see through the darkness. A possible design direction could be to focus on visibility during the night for recreational fishers and provide a safer alternative unit for single or multi-users.

Direct User observation

Observation 1:

The primary key insight that was found through the direct user observation was the poor weather conditions that the anglers faced when fishing on a dock. In their surroundings there were no protective areas that enabled fishing through the harsh weather. The user strains faced by the individuals who were dock fishing presents a possible design direction to incorporate covering aspects for either stationary units or motional units.

Observation 2:

The second key insight that was found through the direct user observation was habitual practices of the user which included the individuals throwing away worm boxes into the water. These creatures require oxygen in order to survive and will eventually die if stuck in the water for too long. The weather conditions also presented difficulty for anglers while using their live

bait, since the foam boxes are carried easily by winds. Incorporating a unit designated for bait could be a possible design direction that would help to aid this user problem.

3.2.2 Activity/ Experience Mapping

The activity and experience mapping for recreational fishers differs in terms of the task that is being carried out for both dock fishing and boat fishing. The below charts demonstrate the current user experience levels for anglers and the targeted experience that is expected to be achieved.

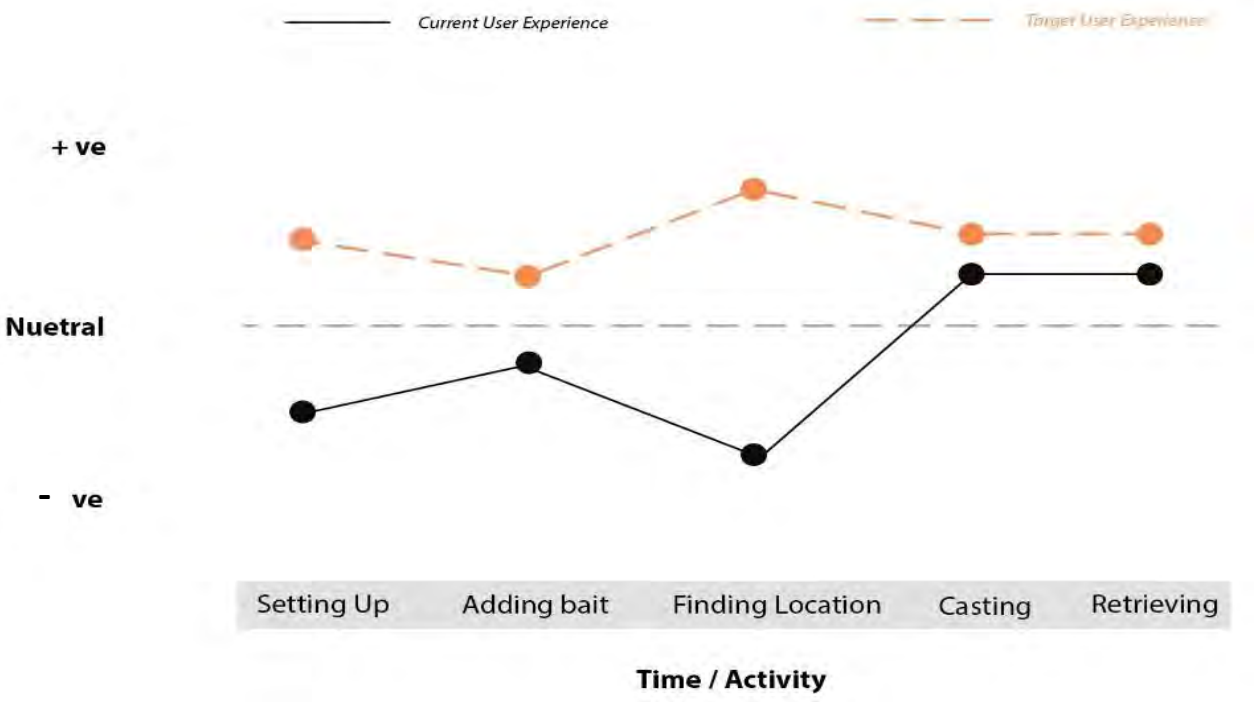


Figure 3-3. Targeted User Experience Versus Current User Experience

Key Activity	Steps	Current user experience	Potential improvement
Setting up the gear	Angler organizes gear and sets up tack on the rod	This task is frustrating depending on the amount of gear and space available. Rods are long and awkward enabling anglers to lay the rods on the floor	Opportunity to provide stands that allow anglers to set up and fix rods without using both hands and needing to lay the rod on the floor
Adding bait to the hooks	Live bait or lures are added to the hook	The current user experience for this task is easy, however, frustration occurs when worm boxes fly away due to wind	Providing stations with worms or worm "bins" on local fishing docks that can be re-used by other fishers or allow the worms to provide help to other systems
Finding a location	Searching for a location that has no casting interference	Finding a location is easy, however, there is an inconvenience of weather which challenges the fishing experience	Coverage from weather that allow angler to fish
Casting and waiting	Cast lines into water and wait for bites	Casting on the dock is easy and anglers are content	Roughly the same
Retrieval and fixing	Anglers retrieve lines and occasionally fix gear	Retrieving and fixing snags on the	Roughly the same

Table 7 – Experience Mapping Improvement Chart

As seen in the above charts, the main improvements include protection from weather, providing more accessibility to baits and rod holders to accommodate the user experience of having to consistently change and alter tackle on rods. This experience mapping was limited to dock fishing, however, through the above user observations in sections 2.1.3 and 3.2.1, cover from weather, space and nighttime fishing aspects needs to be improved.

3.3 Usability – Ergonomics

3.3.1 Introduction

Current benchmarked products geared towards recreational fishing mobility and travel have long been designed predominately to address seating and standing for users and consistently strive for elongated triangular shapes that are open, utilizing wood or aluminum

paneling as the main use of materials. However, modern developments for mobile fishing platforms have been developed, although, are limited in terms of the space and general user use, often allowing one individual to make use of the product at a time as opposed to group participations. Overall, within the development of fishing mobility, these benchmarked products have been catered towards experienced anglers as a primary user and devote little emphasis on products designed for new or less experienced anglers such as the general public. For dedicated and experienced anglers, their adaptability towards mobile fishing products is provided with a vast selection, whereas inexperienced anglers are faced to utilize rental fishing units, that project challenges such as uncomfortable seating, limited space for movement and no protection from poor weather conditions. With regards to this information, the end goal should strive to mitigate user problems faced by less experienced users in order to enhance their overall recreational fishing experience and give opportunity for new fishing developments within a marketing and design standpoint.

3.3.2 Literature Review

Within the market, there are a multitude of recreational fishing crafts that have been designed for speed, balance and space, however, the emphasis on these units are made available to experienced anglers whose budgets exceed the expectation of a publicly cost-effective unit. For the general public, their selection of units available for fishing practices is relatively low and the challenges as mentioned in the above paragraph, have not been addressed in a cost-effective manner for average anglers. The ergonomic buck demonstrated in the following sections will help to identify possible innovations and measurements that can be used in order to manipulate the design in such a way that addresses the concerns and needs of the primary, secondary and tertiary users for the fishing platform. Statistical measurements from the book “The Measure of Man and Women by Alvin Tilley and Henry Dreyfus will be

closely analyzed and taken into account in order to make critical design decisions and alterations that will accommodate users between a 2.5 to 97.5 percentile figure (Alvin R. Tilley & Henry Dreyfus Associates, 2002).

3.3.3 Methodology

The ergonomic evaluation and analysis study of the full-bodied interaction of a recreational fishing platforms overall space, seating and height cover was conducted with the following considerations:

Objective(s)

The aim of this study was to evaluate and determine the overall space and interactive design elements of a fishing platform which include the seating, a protective cover and wall barriers using a full-bodied human interaction in order to mitigate challenges faced by public anglers and eliminate strains for minimum and maximum percentile users. With relevance to the thesis topic, this full-bodied ergonomic evaluation assesses three major body parts in order to maximize the convenience of use and fully determine the functionality of the human factor elements.

Decisions to be made

In order to maximize and enhance the overall experience for recreational anglers, the following interactions were focused on a full-bodied evaluation which includes the three major body part areas as stated below:

1. Getting on and off the platform (Legs)
2. Interacting with side barriers for bait or relaxation (hands, lower back)
3. Seating for comfort (Back, Butt, Thighs)

Description of Users Targeted by Product

The primary targeted demographic is geared towards the general public who are inexperienced anglers ages 19 to 30 and often resort to rentals when in need of a mobile fishing unit. Public anglers are accompanied by groups of 2 – 6 people and spend an average of 5-6 hours fishing on a lake for leisure and to participate in family excursions. Overall, the demographic has a mixture of ethnicities and gender profiles, however, the ratio of males to females is much larger.

Evaluation Process

In order to generate and document a process and system for evaluation, a full scale (1:1) ergonomic buck of a fishing platform was developed and allowed for observation of the following aspects:

1. Observing how the users interact with the overall unit, bending, kneeling & sitting in different positions to accommodate postures related to general fishing practices
2. Identifying critical human dimensions for a 95^{th} percentile male and 5^{th} percentile female regarding their height and the coverage for the fishing unit
3. Observing interferences which may be problematic to the overall design, including additional gear such as the length of rods and additional tackle that is used while fishing which may take up room
4. Seat functionality for users

Description of User Observation Environment Used in This Study

For this study, a one to one scaled mockup was generated using foam core and tape and was carried out in a study room at Humber College. Participants who fit the 95th and 5th percentile ratios were then asked to interact with the mockup for evaluation and observational insight.

Location and Time Frame

Date of Observation(s): 17/12/19 (Observation 1)

Location of Observation(s): Humber College (Observation 1)

3.3.4 Results

Ergonomic Drawings

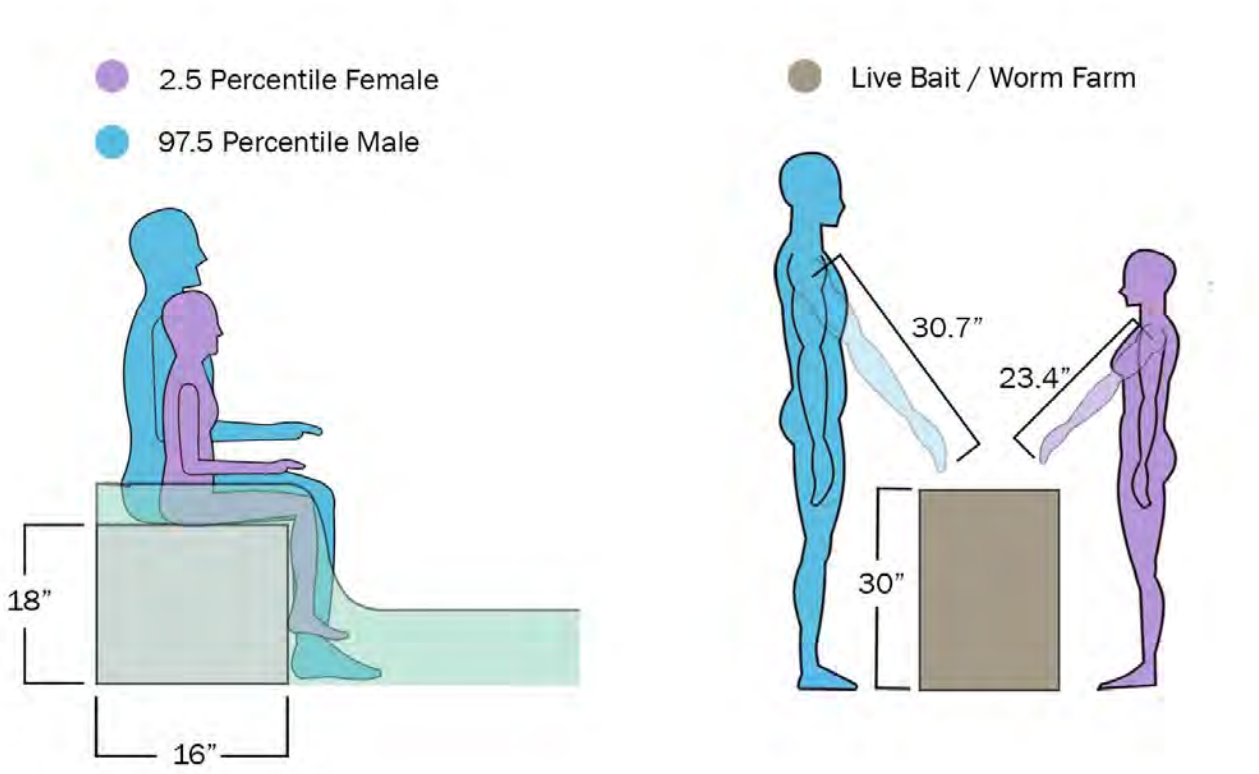


Figure 3-4: Illustrative Ergonomic Diagram of Fishing components

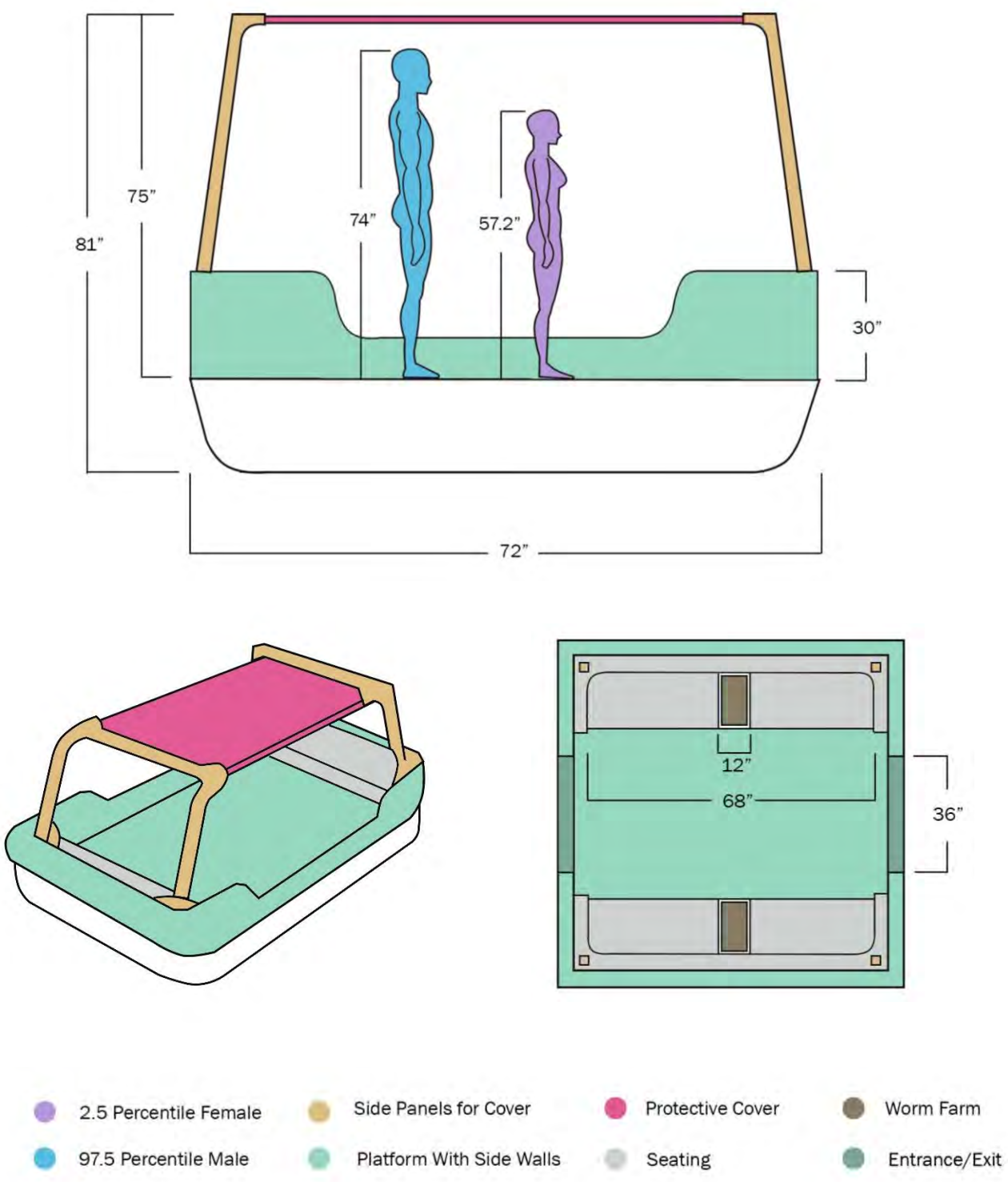


Figure 3-5: Illustrative Ergonomic Diagram of The Overall Fishing Platform

Ergonomic Buck User Observations

95th Percentile Male 5th Percentile Female

Figure 3- 6: 95th percentile male and 5th percentile female standing in the buck platform for protective cover measurements

Figure 3-7: 95th percentile male and 5th percentile female sitting inside fishing platform buck model

Figure 3 -8: 5th percentile female kneeling with buck model fishing rod and pretending to reel

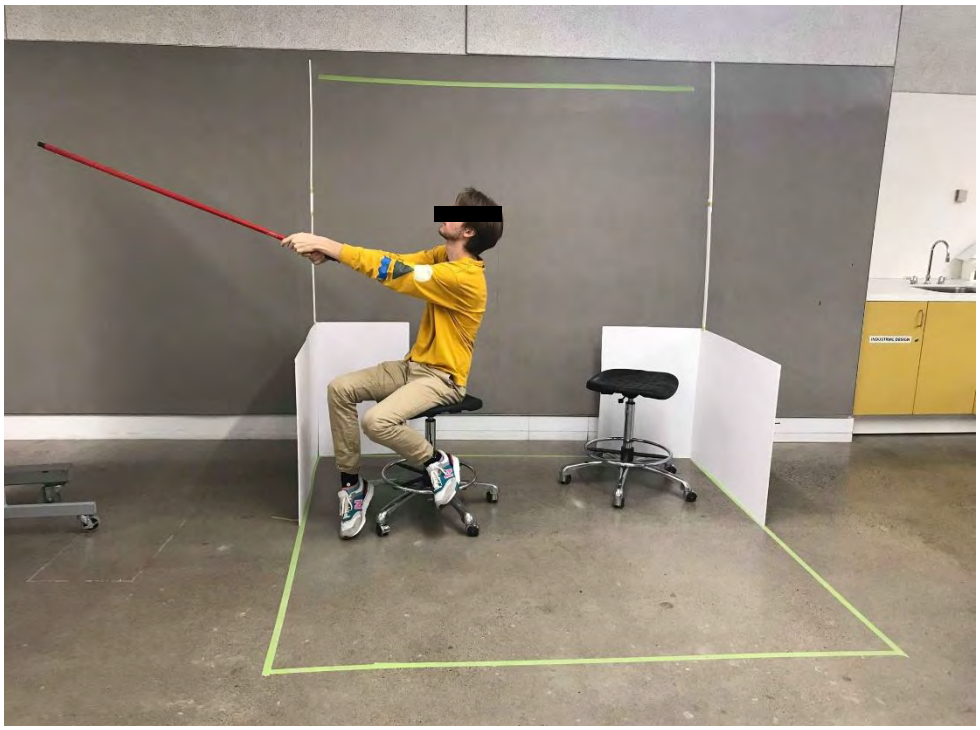


Figure 3-9: 95th percentile male sitting and casting the buck model fishing rod for measurements regarding space

3.3.5 Analysis

The proposed solution, demonstrated through the ergonomic drawings was further carried out and evaluated using a buck model in order to understand the feasibility of the overall design, as well as, generate plausible measurements which were understood from "The Measure of Man and Women" to accommodate 95th and 5th percentile users. The buck model of the platform was focused on holding a maximum of two individuals and was developed using a preliminary outline of the overall unit which allowed for dimensional evaluations of various user positions such as sitting, standing, kneeling and casting; these actions are sought to be carried out by recreational fishers.

According to statistical research conducted prior to the generation of the buck model, recreational anglers often spend up to 5 – 6 hours when fishing from a craft and utilize fishing gear which includes nets, rods, tackle boxes and live baits (2005 Survey of recreational fishing in Canada, 2009). Additional research shows that anglers also participate in the sport with an average group size that varies between 2 to 6 individuals (2018 special report on fishing, n.d.). With regards to this information, the buck model was created in order to give insight to the following features, the seating, overall platform size for various angler movements, fishing platform height for the protective cover and side panels for protection of falling overboard as well as for the ease and access of live bait available on the platform.

With the creation of the buck model, the first unit of measurement that was considered was the base of the platform which would need to hold up to two individuals. The overall width and length of the platform was set at a measurement of 72 inches, with a total area of 5184 square inches or when converted, 36 square foot. This measurement allowed for both individuals the 95th percentile male and 5th percentile female to fish and move withing the

space without bumping into one another and allowed for posture changes and movements such as kneeling and crouching, reflecting that one can reel in and retrieve fish. These movements were carried out by the participants so that the researcher could analyze the space and limitations that could be faced within the set measurements. With an addition to the overall platform, the entrance and exit for the unit were measured at 36 inches wide.

The second feature that was studied through the buck model was the seating relevant for anglers to relax, cast and fish without restrictions. As analyzed in "The Measure of Man and Women", the seat height was set at a standard distance of 18 inches from the ground to the top of the seat. The buck model consisted of two seats which had a total length of 68 inches from one edge of the seat to the other, however, the length of a single seat for the purposes of the buck model was 16 inches wide, allowing for a 36 inch gap between the female and male individuals. When evaluated, the 95th percentile male and 5th percentile female were able to sit comfortably with enough room for knee space, however, a restriction included being able to spread their legs out without kicking the other individual as well as potentially hitting one another with their rods when casting. This analysis shows that within a space of 36 square feet, the seating could potentially be further apart for more relaxation and freedom to adjust one's body in alternate positions such as stretching.

The third feature of evaluation included the height of the fishing platform for a potential cover which would aid to protect anglers from weather conditions such as rain, an obstacle that is faced for many anglers today which is being able to participate in the sport comfortably through various weather conditions. The height of the unit was guesstimated using the height of the 95th percentile male user who was 73 inches tall. The overall height of the cover for the fishing platform was set at 75 inches tall. Based on the measurements, the 95th percentile users head did not interfere with the cover, however, the height for the final solution should be

adjusted to a height of 80 inches, allowing for more space in the case of a 97.5 percentile male user. The height of the 5th percentile female user was approximately 60 inches and did not have interference problems with the cover suggested for the unit.

The final ergonomic evaluation was conducted using the side panels of the fishing platform. These panels were made to generate a suggested vision of what the final unit could have but does not entirely reflect how the side panels will look for the final design of the fishing platform. The side panels in the buck model were 30 inches tall, 24 inches wide and 48 inches long on the sides of the platform model. When stood next to, the 95th percentile male and 5th percentile female did not need to bend in order to grasp the sides of the panels and acted as a barrier for the users. In the final design, the side panels also may contain live bait such as worms which would be in reach for the users, however, this aspect is still under consideration in terms of the location and overall aesthetic. Overall, the side panels should not be shorter than 30 inches and has the potential to increase to 35 inches without restrictions.

3.3.6 Limitations and Conclusions

The following points identify the critical human dimensions which affect the fishing platform unit and user experience.

1. Users are unable to fully extend their legs when sitting without hitting one another
2. The height of the cover for the fishing platform does not accommodate someone who is larger than 73 inches tall and risks someone bumping their head into the cover
3. When fishing back to back, there is a risk of someone getting hit with the fishing rod when someone is casting

Some Ergonomic Issues That Are Still Not Yet Resolved

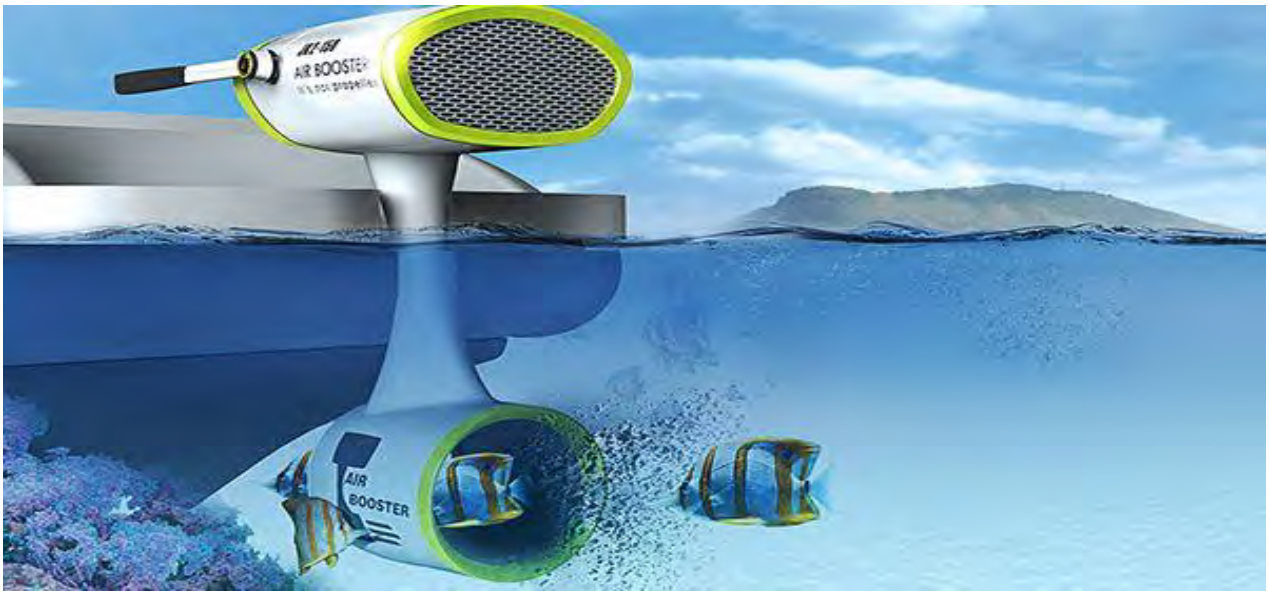


Figure 3-10. Roblin. A. (2014). Bladeless Boat Engines [Digital Image]. Retrieved from https://www.trendhunter.com/trends/air-booster-motor

Some of the ergonomic issues that are still present through the design solution and measurements include the closeness in user proximity when utilizing fishing gear such as rods and user positions being constricted due to the measurements and location of seating. Additionally, the height of the protective cover is a concern that should be evaluated again with the reference of a 97-percentile male. Nonetheless, some limitations to this study included not being able to evaluate individuals who vary in weight; this could potentially suggest new measurements for the platform, as well as, not being able to test the flotation and balance of the unit. This study was also limited to ergonomic evaluations and did not fully explore the potential for user interactions with mechanisms such as motors or digital control panels that have been developed with new innovations such as the Yanko Bladeless Motor concept, which could be applied with ergonomic considerations.

Alternate Possibilities for the Future

The alternate possibilities based on the current ergonomic evaluation and with reference to the prior studies, that could be explored in the future are as follows:

1. A small test study generated to mimic the balance and stability of the unit in relation to weather conditions that could be faced while in use, in order to understand the potential limitations and areas of concerns when on water.
2. Understanding day to nighttime fishing concerns and ergonomic issues by mounting a camera onto an existing unit.

Overall, this ergonomic evaluation study of the fishing platform helped to understand potential measurements for both male and female anglers in the ranges of 2.5 percentile to 97.5 percentile body type. The study identified the areas of concern that continue to be evaluated in order to enhance the recreational fishing experience for inexperienced anglers and establish future research possibilities that could later be applied to the final design solution for the recreational fishing platform.

3.4 Aesthetics

Introduction

When it comes to watercraft products for recreational fisher, the designs are primarily based on function versus aesthetics and are geared towards keeping the balance upright for anglers. The most popularized aesthetic forms include elongated, triangular shapes for speedboats and dinghy boats, however, there has been some form exploration with other products in the market that are subtle such as fishing platforms. These products have been generated used simplistic shapes such as squares and circles, an example being the Ultraskiff 360. The materials for crafts and platforms, generally uses plastic due to the lightweight characteristics and chance for interchangeable parts. Overall, there is an opportunity to

expand the materials towards sustainable choices and aesthetics can be more playful and aid in the user experience through modularity.

Form Language

The form language of current recreational fishing platforms and boats are open concept forms in terms of not having covers or walls surrounding the users and some designs allow users to engage in different ergonomic positions such as kneeling down, however, the general form language of products constraints anglers to sitting. The form Overall, there is an opportunity to expand the materials towards sustainable choices and aesthetics can be more playful and aid in the user experience through modularity. The design should be inviting and allows individuals to fish for long period of time through comfort.

3.5 Sustainability – Safety, Health & Environment

Safety

The current safety concern for the proposed fishing unit will continue to be the balance of the unit, with reaction to the water. The goal for the end unit is to provide space to eliminate users from stumbling into each other. The stylistic approach to the unit will also be designed in such a way that the balance of the unit will closely follow similar functions of the Ultraskiff 360 where the entirety of the unit is balanced out in accordance to movement and the water; this will reduce user fears of falling overboard the boat.

Health

The health for anglers is extremely vital when using recreational fishing products, especially for mobility and travel. Currently, there is little emphasis targeted towards the health of users when they are faced under weather conditions such as rain or hail. The health of users can better be accommodated through covers. The health of anglers is also accommodated

through safety aspects such as the use of lifejackets which is external from the design of the fishing unit.

Environment

The construction of the fishing unit is dependent on the material used for the product such as plastic due to its lightweight characteristics and resistance to rust. The overall material will complement the conditions that the unit is faced in. Environment will also be considered through the motors used to make the unit mobile such as utilizing new advancements in technology such as the fish friendly, bladeless motors, conceptualized by Yanko Designs.

Product End of Life

As mentioned in section 2.2.5, the end of life for current benchmarked products is considered depending on the material used for the unit, whether it be aluminum or plastic. In terms of the finalized solution, there is a chance to develop the unit using recyclable plastics or newly, scientifically investigated materials that are upcoming. The research for materials which will determine the end of life is still under consideration, however, will adapt to the challenged use of the product and environment.

3.6 Commercial Viability

3.6.1 Materials and Manufacturing Selection

The commercial viability of the product is dependent on the materials, manufacturing and production of the final product. This product is not meant to be produced for a mass market and should be produced for commercial use by Canadian fisheries, piers and lakefront property owners. The manufacturing methods that will be used to produce multiple of these units include, rotational molding, injection molding, metal working and casting processes in order to generate parts. Materials for this unit will mainly include, High Density Polyethylene,

polyester yarns and aluminum for most of the metal applications on the unit, due to its lightweight factor and the sustainability factors of these materials. Both the manufacturing processes and material choices will allow for a viable and long-lasting product that is capable of enduring harsh weather conditions, predominantly when used on water.

3.6.2 Cost

Due to the incorporation of newly advanced technologies, which will be further explained in section 5.6 of this report, this product will be considered a high-end unit, with a considerably high cost, not meant for regular in-store marketing. However, the price will be considerable for those who work and classify within the recreational fishing industry, such as pier owners and fisheries as noted in section 3.6.1.

3.7 Design Brief

The goal of this thesis project is to enhance the recreational fishing experience for primary, secondary and tertiary users by mitigating current user strains and bring attention to better aquatic solutions that will help to mitigate destruction to aquatic ecosystems. The following list showcases the objectives that are to be met by the solutions

- Provide modularity for users to accommodate space
- Mitigate aquatic damage through “fish friendly” systems
- Provide incorporated shelter for anglers from various weather conditions
- Ensure there is space and storage for user tackle gear
- Generate sustainability through user experience and bio-developments (integration of bait stations or units for anglers which can also aid in aquatic cleanup)

- Upgrade the aesthetics to fit a futuristic appeal for anglers as opposed to the dated designs
- Challenge the market by generating a product that differs from boats and generic platforms

4 Design Development

4.1 Ideation

4.1.1 Mind Mapping

In order to start the design development process, a mind map was generated to further explore and expand on variables related to the concerns revolving recreational fishing for the general public which include fishing enthusiasts and inexperienced anglers. The mind map includes expansion in the following catergories, engagement, ease of use, aesthetics, ergonomics, interaction and as well as safety.

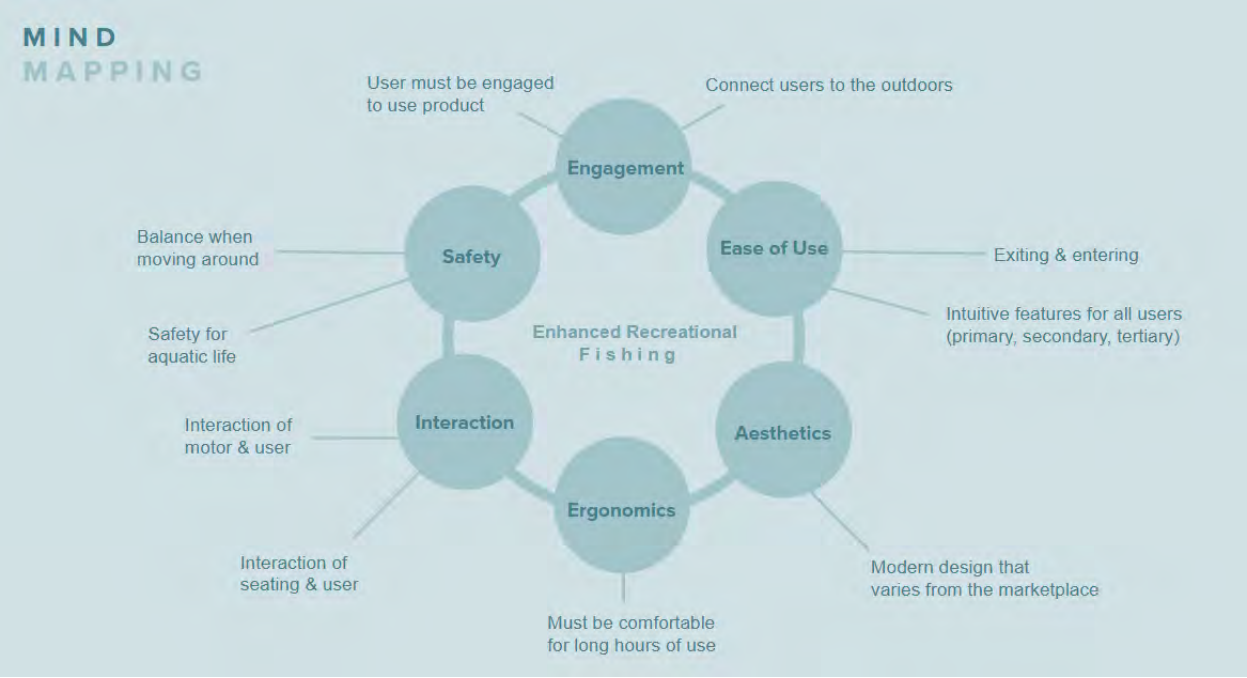


Figure 4-1. Mind Map of Expanding Variables

4.1.2 Inspiration Board

Figure 4-2. Inspiration Board for Elements of the Final Product Design

The inspiration board shown in figure 4-2 demonstrates a broad spectrum of elements that give inspiration to the final design solution; this includes a form analysis using graphical images and existing products, mechanisms that exists within the market, lighting and nonetheless color and textile variations.

4.2 Preliminary Concept Exploration

During the initial stages of concept exploration, various ideas were generated in order to develop a product that enhances the recreational fishing experience for general fishing enthusiasts through new explorative means while tending to the issues that anglers face and are present in current benchmarked solutions such as poor seating, space and protection from harsh climate conditions including extreme heat or rain.

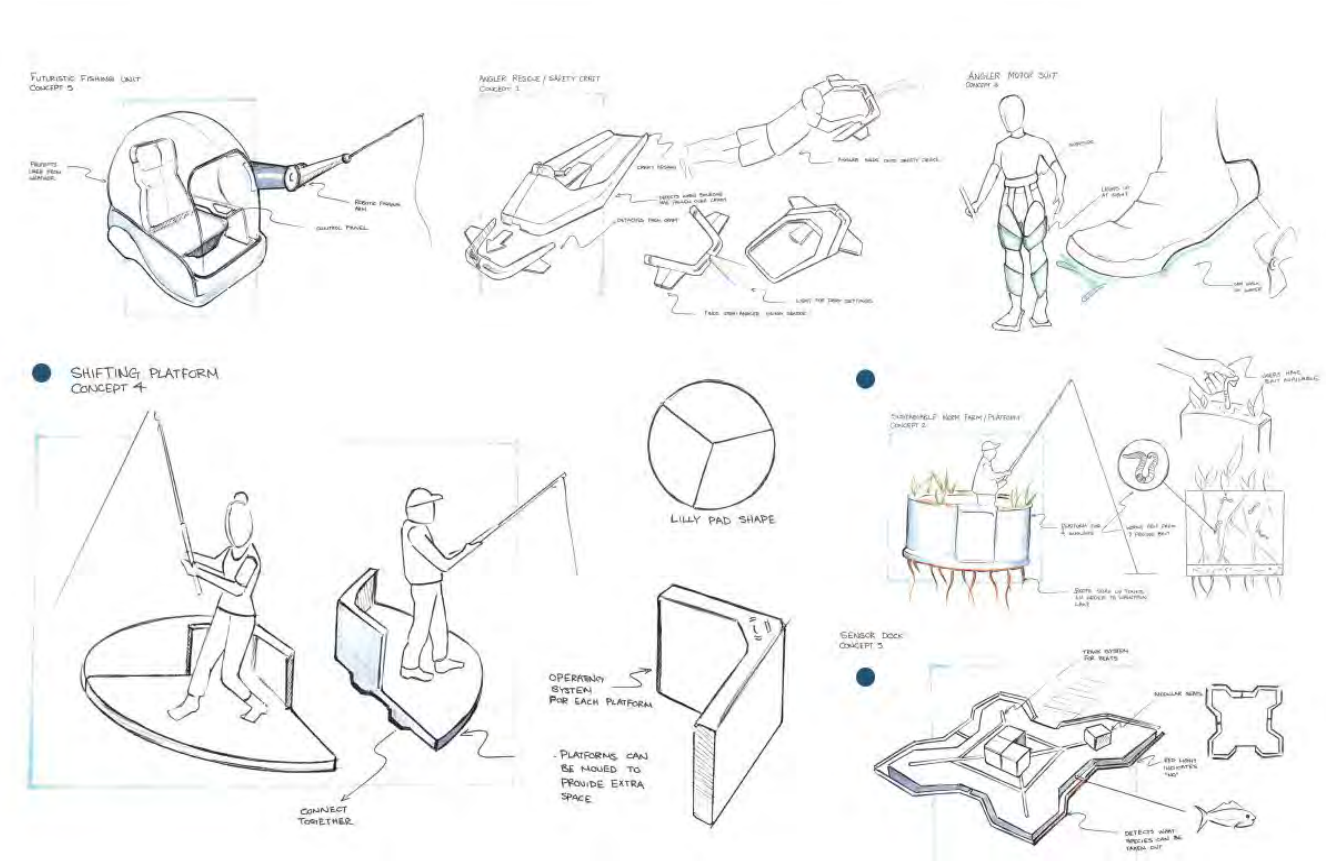


Figure 4-3. Concept Exploration Sketches

Much of the concept exploration ideas included futuristic units that would house the users from rain or sun as well as single user fishing concepts which enables individuals to walk freely on water using a suit or motorized shoes. However, the more contemporary ideas which also had slight futuristic aspects included modular fishing units that could attatch and detach when needed in order to make the fishing experiece more flexible as opposed to adjusting to

the contraints of fishing from a boat. Many of the concepts also included fishing doc variations, and encorporated worm farms which would allow anglers to have bait readily available on the unit itself. Overall, three of the six initial concept exploration ideas were joined together in order to inform the final design direction; this included a combination of the worm farm, modular fishing platforms and the modular fishing doc concept, each idea allowing for the contribution of a relaxed, ehnaced and modern approach to recreational fishing.

4.3 Concept Refinement

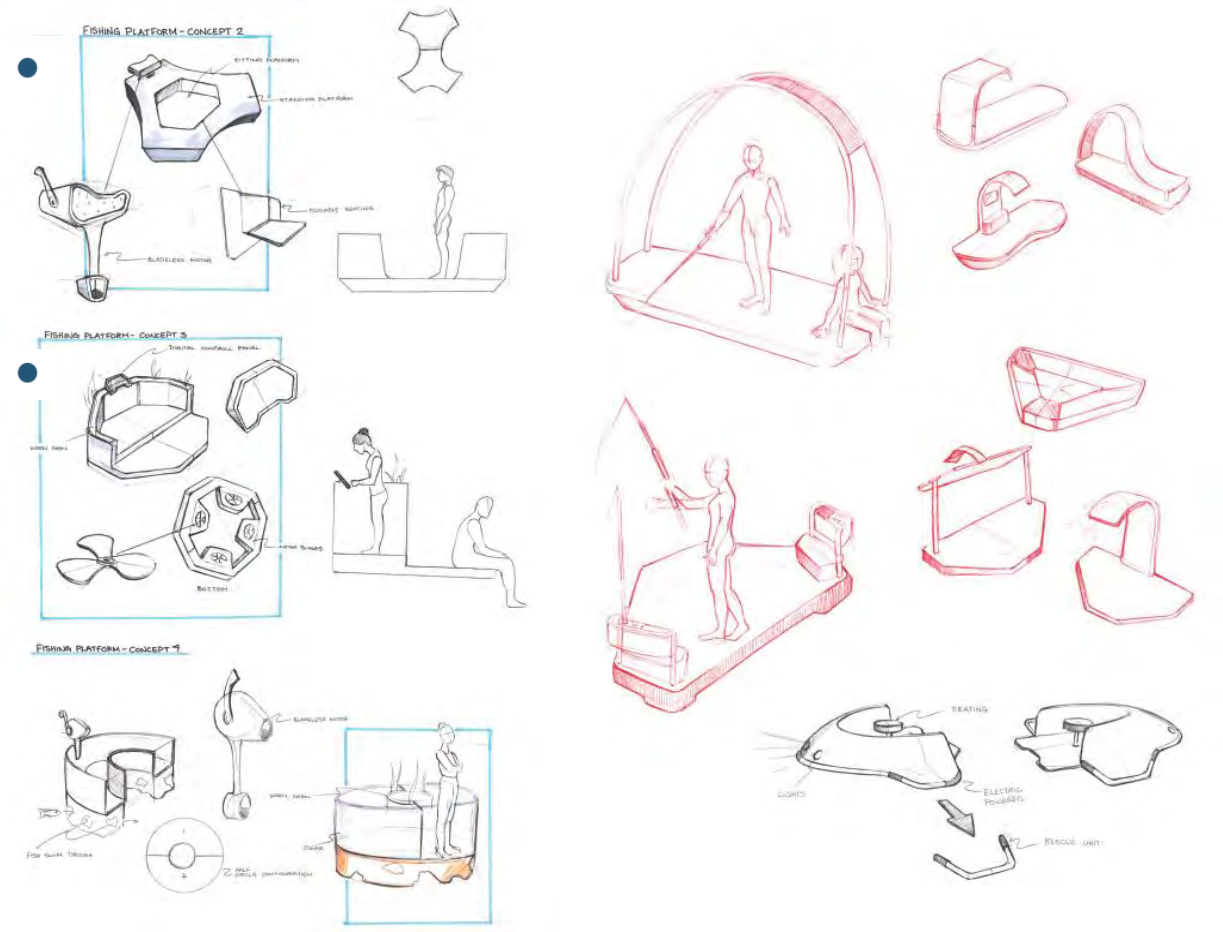


Figure 4-4. Concept Refinement Sketches

Once the concept exploration was completed and was narrowed down to a plausible solution, the overall refinement staged focused heavily on the outer shape of the unit as well as details that would be incorporated; this included the platform base, possible seating, an accessible bait unit, motors and a navigation system for the autonomous capabilities of the unit as shown in figure 4-4.

4.4 Detail Resolution

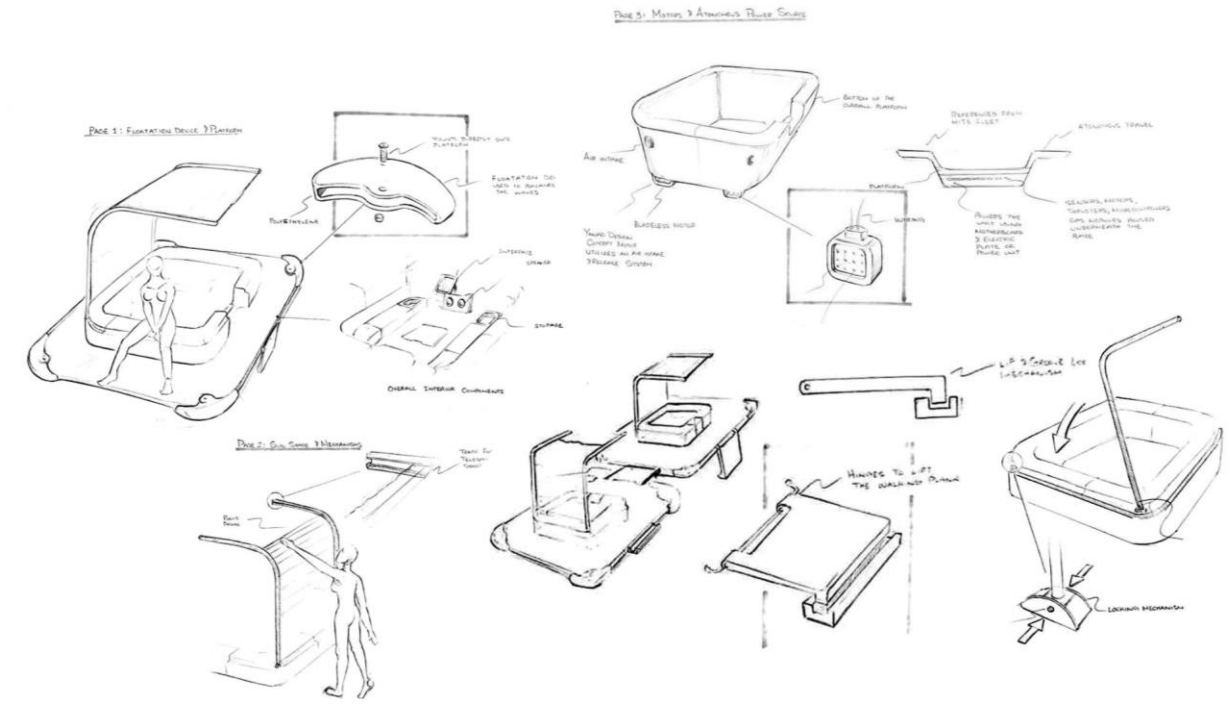


Figure 4-5. Preliminary Detail Resolution

During the detail resolution stage, the form design of the unit was still under development, however, many of the details such as the motor and technological capabilities were defined in order to suggest a working solution for the final outcome of the modular fishing platform. As shown in the above images, the touch screen display, seating, and the modularity of the unit were key aspects that were at first, symmetrical, however, this form changed due to the similarity that the platform had in comparison to benchmarked products that were in the market. The finalized and changed formed included an asymmetrical triangular shape that allowed for better connectivity between the units and provided design interest for the solution.

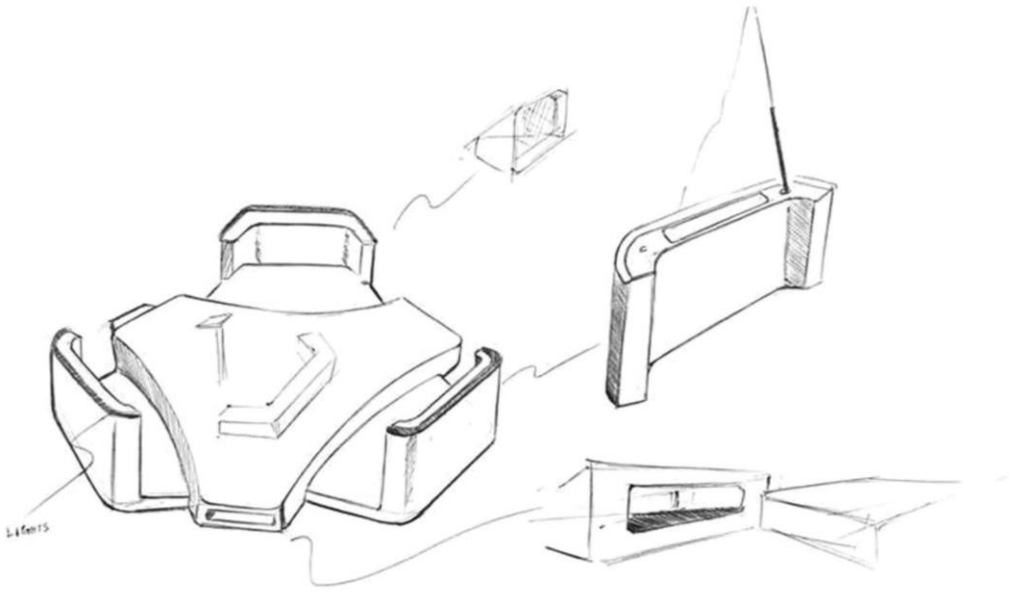


Figure 4-6. Final Shape Resolution

The final shape resolution resulted in a triangular base with outer wings in order to provide aesthetic interest and differentiation in the product. However, the side walls of the unit were still in question due to the dimensions and needed to be further evaluated through sketch models and in CAD in order to provide a three-dimensional study. Although the base shape changed from a rectangular form to a triangular form, the features designed and further evaluated during the preliminary detail phase were able to co-ordinate with the newly developed shape and were further constructed to fit the form of the unit.

4.5 Sketch Models

Figures 4-7 & 4-8. Preliminary Shape Sketch Model and Secondary Shape Sketch Model

Figures 4-9 & 4-10. Initial Seating Design in an Upward & Downward Position

In order to further understand scale for the overall design, hard model and proportion for ergonomic considerations, a 1:13 scaled model was generated using illustration board and foam core for ease of relevant changes. Both the base of the rectangular design and triangular design of the fishing platform was developed in order to compare aesthetics and measurements

4.6 Final Design

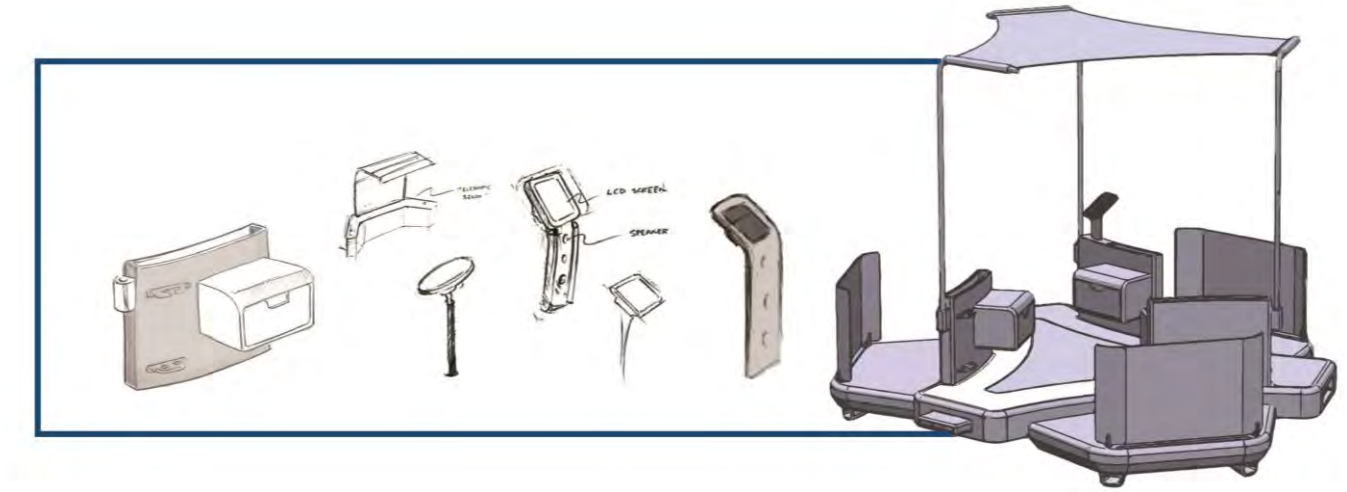


Figure 4-11. Final Design Concept & Form Sketches

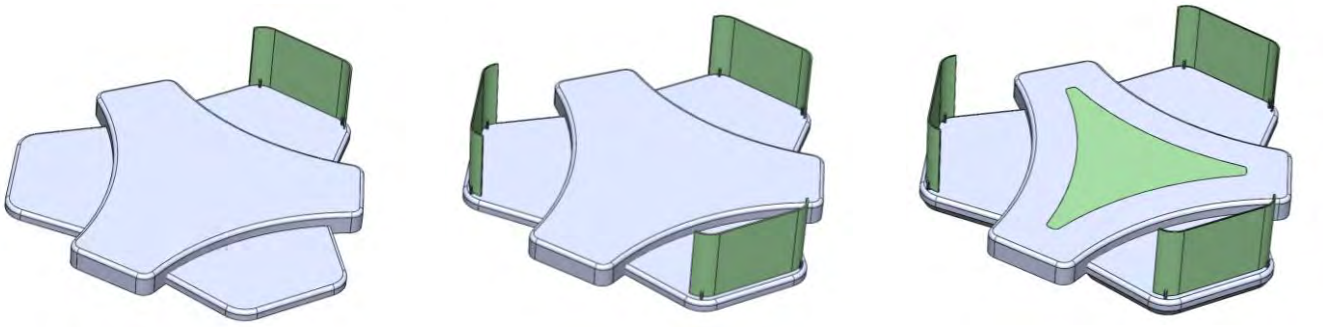
With exploration, detailing and in depth design considerations, the final design for the fishing platform was developed, including it's features and technological aspects. The overall design aims to provide a sense of openess, freedom and connectivity with nature by providing visibility around the unit. Aspects such as the sunshade, seating and touch screen display were better developed to co-ordinate with the shape of the platform, as well as, allow users to freely move about by placing the each component in such a way that would not allow them to become an obstruction.

4.7 CAD Models

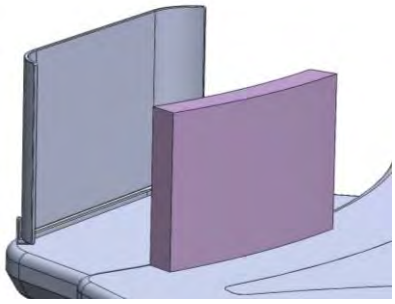
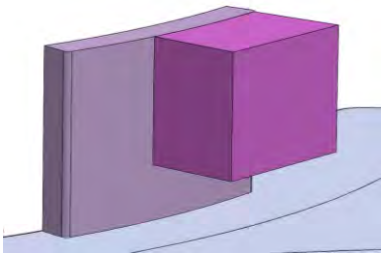
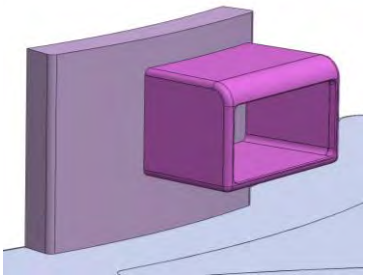
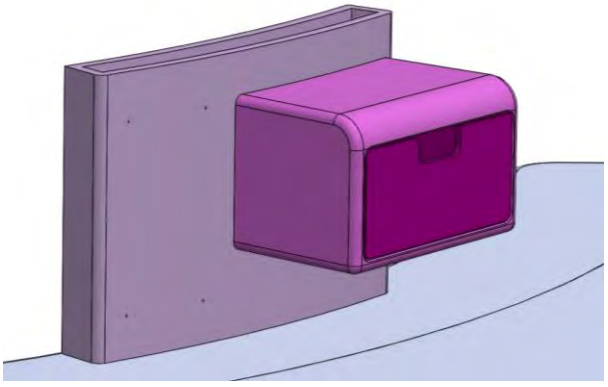
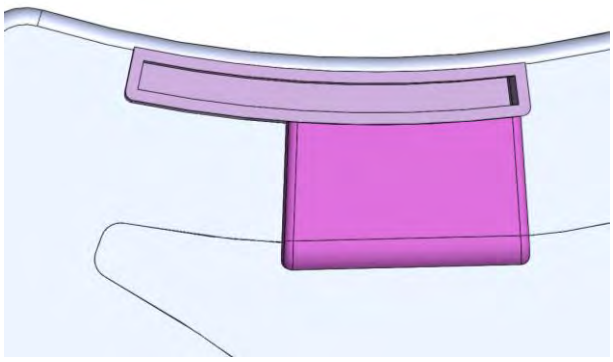
The following images demonstrate the CAD developmental process of Floatex, as it was generated using SolidWorks. The design was first developed using a base formation and then comprised of additional features and aspects that were understood in the concept development stage. However, many of the design elements were tweaked, in order to fit the aesthetics of the base formation and continue to better the ergonomic relations of the unit.

Floatex Base & Outer Wings

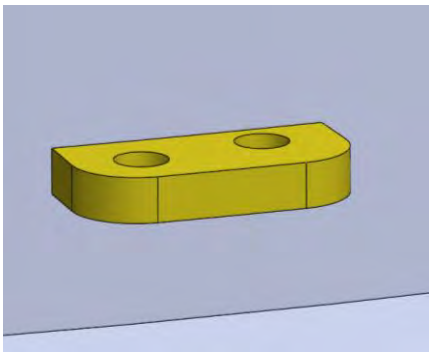
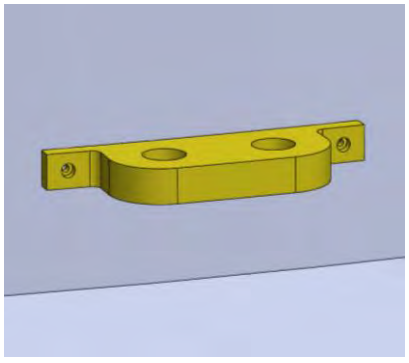
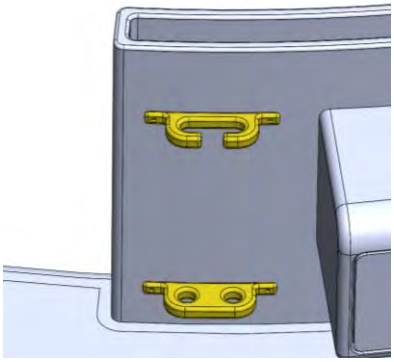
Glass Panels & Base Development



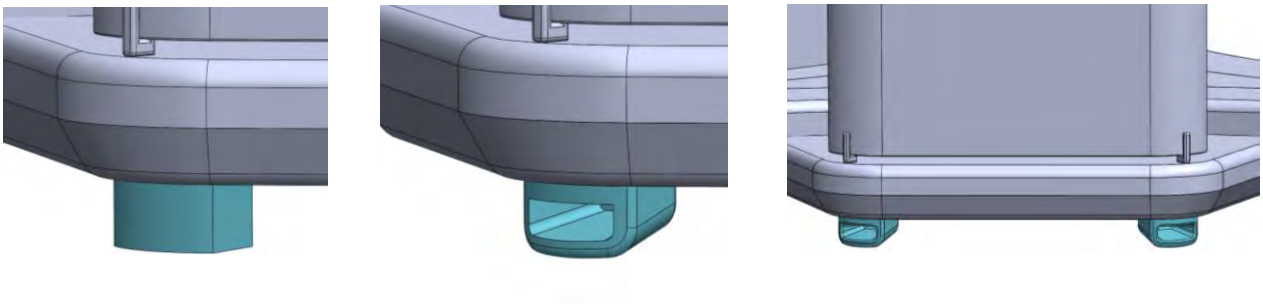
Interior Wall & Seating Development

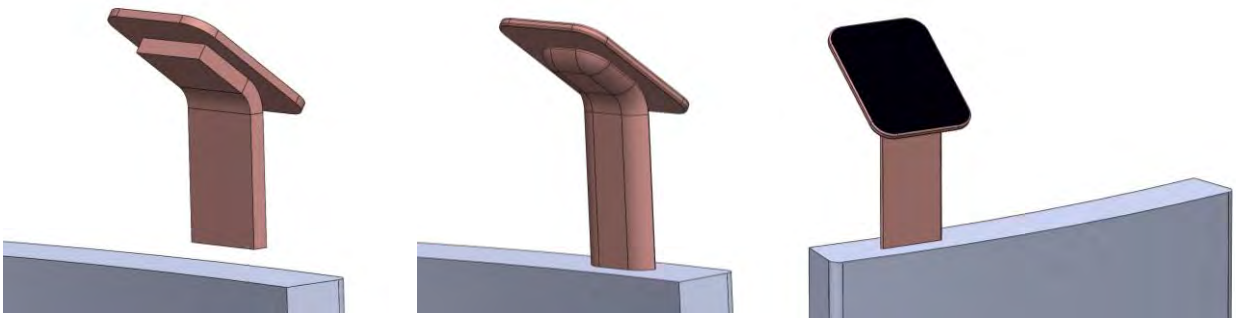
Fishing Rod Holders

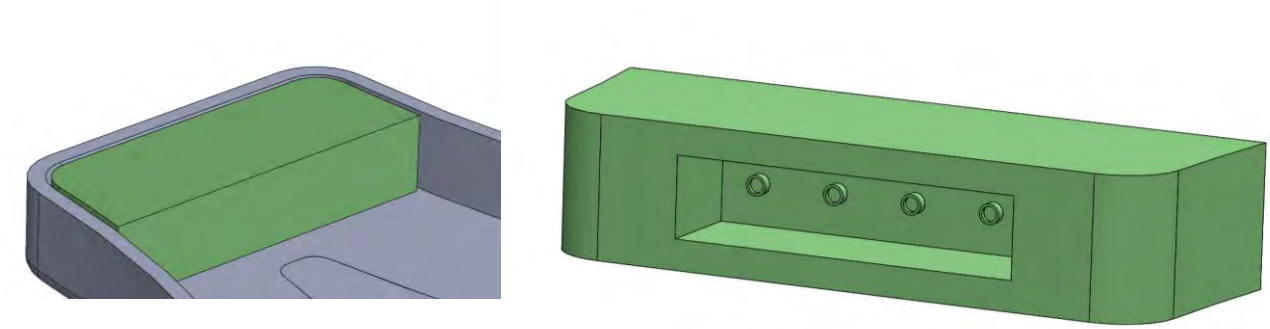
Motor Development



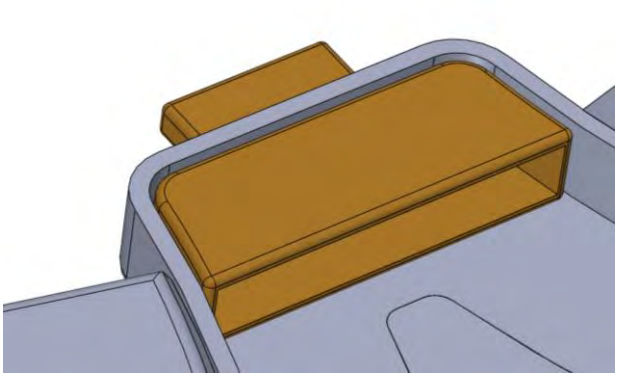
Touch Screen Display

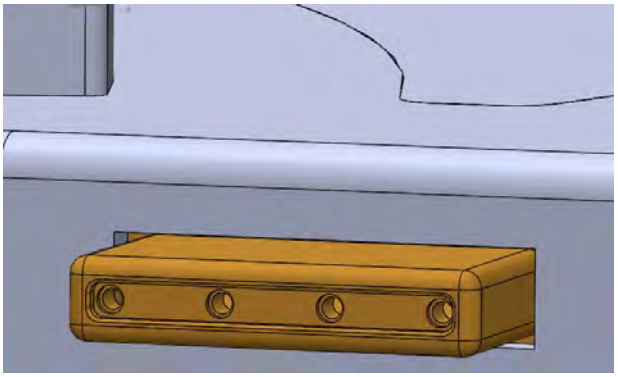


Receiver Development

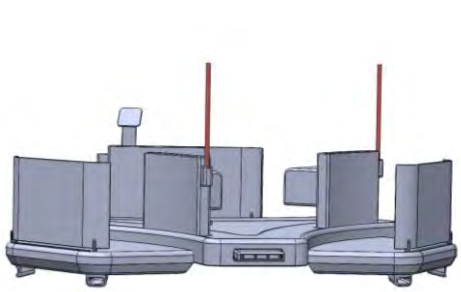


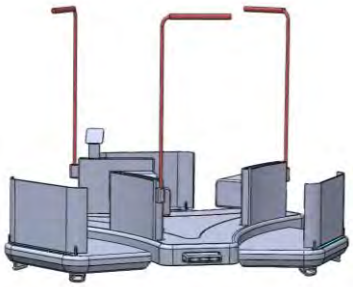
Connector Development

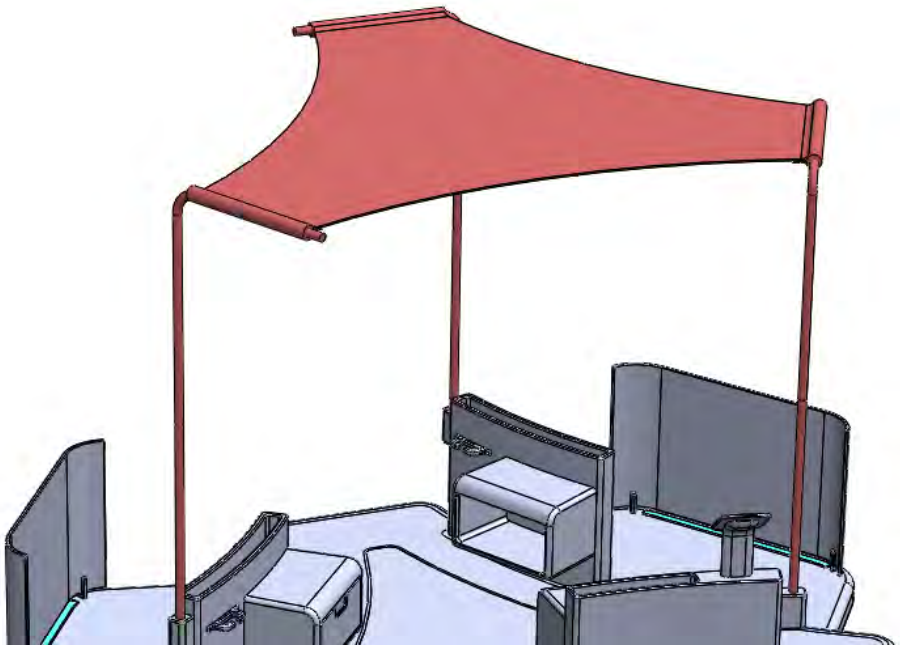




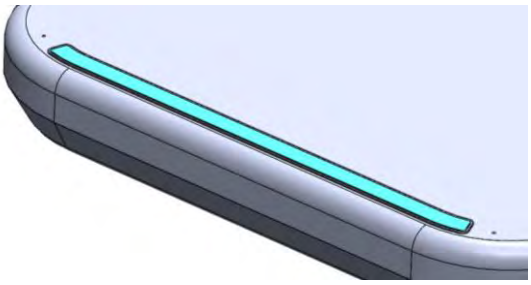
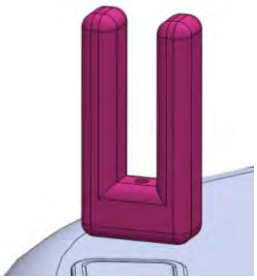
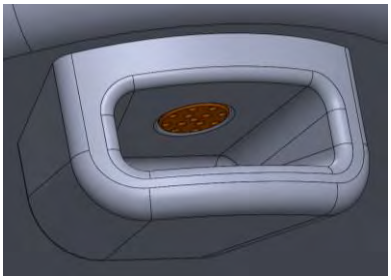
Sunshade Development



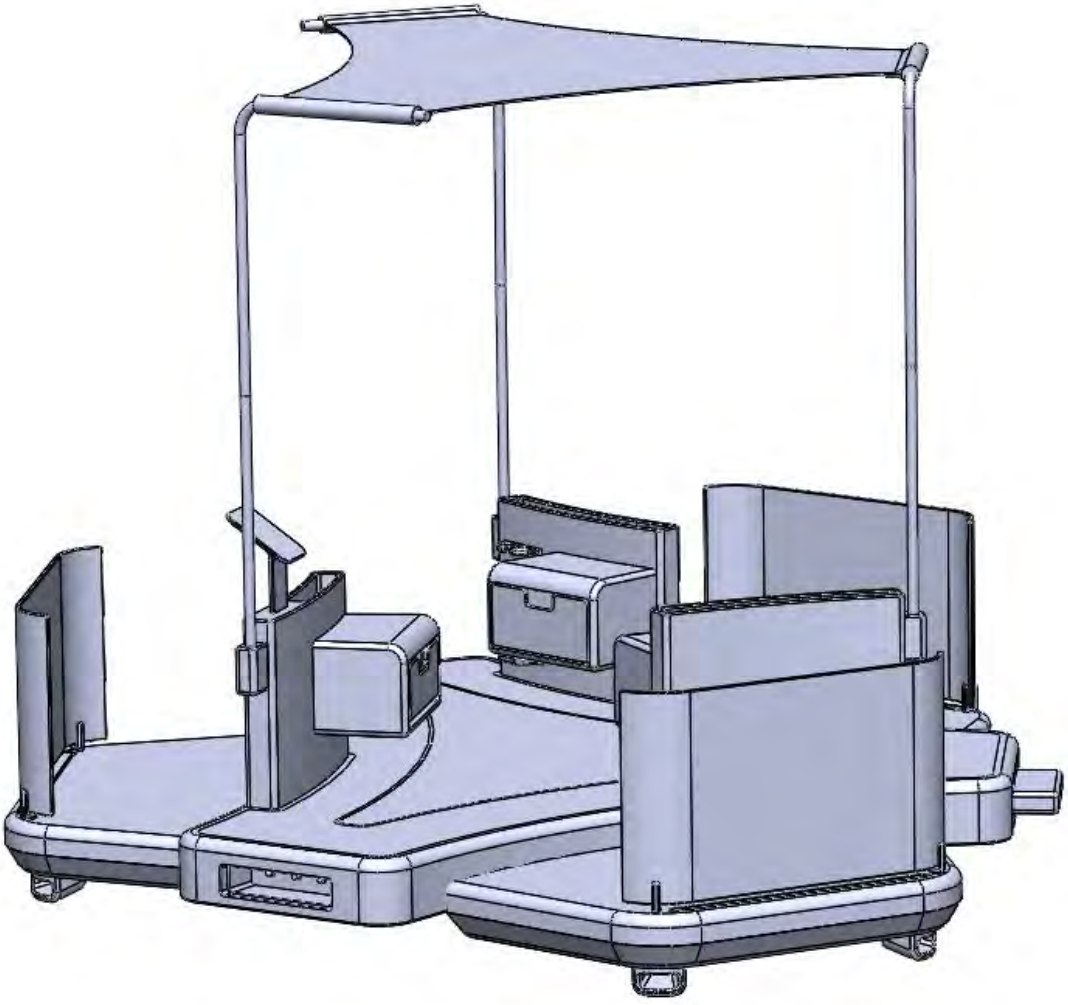




Additional Feature Developments (Lighting, Water Intake, Peg Holders)

Overall Unit Development



4.8 Hard Model Fabrication History

The hard model development for Floatex was first generated using the CAD model created in the above section 4.7. Using the CAD model, a 3D print of the unit in 1/13th scale was outsourced from Agile Manufacturing, using SLA material. The model was sanded using 300 grit and 600 grit sandpapers and was put in water for a smooth finish. Due to the circumstances of school, the model was built outdoors and was painted with light and dark grey finishes. The color schemes chosen for Floatex, included a dark grey base, light grey outer-wings and light grey for the interior walls and seat in order to give the model a variation in shades. The propellers for the unit were also a dark grey as it adds contrast to the overall design. Additional color schemes for Floatex included a vibrant green for the fishing rod holders and the storage bins, allowing the unit to incorporate earthy tones that give feelings of vibrancy and freshness, in correlation with the environment that the unit will be in. The touch

screen display has a sleek black cover, that was mimicked using many coats of black spray paint and the touch screen display stand was painted using a metallic finish. Additional parts added to the hard model, included transparent panels for the sides of the unit as well as a transparent piece for the base of Floatex; these parts were also outsourced from Agile. All in all, the model was assembled used Krazy glue in order to securely mount each piece together. Overall, the cost of the hard model was $450 for the initial prints and approximately $100 for finishing materials, including the spray paints, sanding paper, tape and glue as well as some additional supplies needed to paint outdoors. Many of the parts that could not be included due to difficulty in outsourcing, included fake plants, figurines and small doll parts such as fishing rods. The following photos below demonstrate some of the steps and history of the hard model process for Floatex.

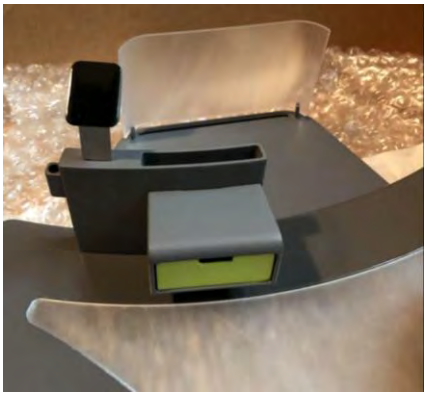
Photos Taken During the Sanding Process

Photos Taken During the Painting Process



Photos Taken During the Assembly Process






5 Final Design

This chapter outlines the final design outcome for the topic of recreational fishing, including the problem, Floatex as the targeted solution, its benefits as well as highlights the major sustainability factors that Floatex presents. This chapter aims to combine the research and learning outcomes noted in the previous sections in order to fully expand on the final design solution generated for modern recreational fishing practices and fishing enthusiasts.

5.1 Summary

5.1.1 Description

Floatex is an ergonomic and modular recreational fishing platform designed to be used by the general public and fishing enthusiasts. Floatex is equipped with autonomous capabilities, allowing the unit to conform from a single moving platform to a stationary dock, providing a modern approach to fishing transportation units and allowing flexibility for general anglers and families.

5.1.2 Explanation

Through past design developments and in the market today, there is a broad range of products that have been developed for fishing, specifically targeted towards water transportation, allowing anglers with more freedom to cover vast areas of water. Although many of these products have become ubiquitous, such as boats and kayaks, most of these products are expensive, geared towards expert anglers and most importantly, face environmental and ergonomic challenges such as poor seating, poor stability, little coverage from weather conditions such as rain and nonetheless some pollute lakes through gas and oil leaks. With a combination of these problems, there is a decrease in the number of individuals

practicing the sport and millennials today are not as appealed to the sport due to the underdevelopment of technology and ease within the recreational fishing industry.

As such, Floatex was designed in order to provide a flexible, advanced and aesthetically modern solution that promotes recreational fishing for families, fishing enthusiasts and future millennials. Through the advancement of better seating, accessible bait units, fishing rod holders, lighting and optional coverage, users can enjoy fishing with ease and can also expand their fishing experience from daytime, to nighttime fishing. Floatex encompasses autonomous capabilities, lessoning the hassle of motor startups and instead, is powered through electric capabilities first introduced by MIT researchers, as expanded in section 5.6. Sensors and internal mechanisms allow for Floatex to connect to one another, increasing the size of the unit in the case that there are more than 4 individuals who would like to fish together. Alongside the features, Floatex provides storage bins that are housed underneath the seat; these can be used for storing items such as food, fish that are caught or tackle and also provide a solution to store life jackets when the unit is not in direct use. Nonetheless, the touch screen display on Floatex allows for users to navigate the unit using a 3D map of the lake, as the connection is synced with the motors underneath the platform. The touch display can also be used to locate fish, check weather conditions and possesses the future possibility of using a Wi-Fi connection for additional apps and features.

5.1.3 Benefit Statement

Overall, Floatex benefits general fishing enthusiasts, families and individuals who are inexperienced to the sport of fishing by accommodating space and features designed for ease of use and accessibility. With the increase of space through connecting more than one unit, individuals feel as if they have more freedom to move in any position, including standing,

bending, kneeling or sitting and are more inclined to go fishing with family and friends. Individuals also have more leisure to fish at night as the lights on Floatex allow for visibility in the dark. Additionally, with the integration of electrical components and using sustainable materials, Floatex impacts the fishing industry through sustainable means and promotes gas free solutions that continue to allow species to thrive.

5.2 Design Criteria Met

5.2.1 Ergonomics

In comparison to benchmarked products made available for the general public and fishing enthusiasts, such as rental boats and kayaks, Floatex is a much more ergonomic solution and provides maximum comfort and space for individuals to carry out any necessary movements while fishing.

General Platform Shape

The fishing platform developed for Floatex consists of a large base and three outer wings which provide a maximum space for up to 3 or 4 people without the unit becoming overcrowded. The openness of the triangular shape allows users to move either on the major platform or outer wings and allows individuals to adapt to different positions such as sitting, kneeling, bending or standing; these positions are most often practiced when reeling in and capturing a hooked fish. Overall, Floatex measures out to be approximately 11′ - 2″ by 11′ long, allowing users to cast in various directions without stumbling into one another or overcasting into one's personal space.

Seating & Bins

The seating for Floatex is 18" inches from the platform to the top of the seat, allowing for a general measurement that is suitable for 95th percentile male individuals and as low as a 5th percentile female individual. The seating for Floatex consists of storage bins that are tucked inside of the seat, allowing for users to place items inside such as food, fish capture or general tackle. Although these bins require a slight bending formation from users, the housing area of the bins do not require much effort for individuals to use and slide in and out for easy access. The overall seating unit has a fixed back support and can allow users to rest when needed.

The positioning of the seats inside of Floatex were developed in such a way that allow users to sit alone and have a separate are for themselves. Although Floatex as a unit can be used for family fishing recreation, the unit when not in use by groups, becomes part of a stationary floating dock system and formation that can be used by the general public. As such, when Floatex is in this dock formation, individuals who are separate from one another are free to use the space; the positioning of the seats accommodate for privacy and space.

Worm Farm

The worm farms housed on Floatex are designed at a height that does not require families or fishing enthusiasts to bend when bait is needed. Young adult to mid adult individuals are able to reach the worms through a simple arm stretch and grab contact relation.

Sunshade

The optional sunshade, developed as part of the features of Floatex, is stationary at a height of 7' - 9" high, allowing 95th percentile male individuals to stand underneath as their measurement is slightly taller than 6 feet according to anthropometric data, as stated in "The

Measure of Man and Women" (Tilley & Dreyfus, 2002). This measurment was first calculated through in depth research and applied to Floatex in order to accommodate the tallest percentile male individual.

5.2.2 Materials, Processes & Technologies

The final materials that were chosen for Floatex were considered due to their durability to withstand harsh weather conditions, sustainability and end of life processes and additionally their weight factor in order to consider the floatability of Floatex.

High Density Polyethylene

In terms of materials, HDPE was considered for it lightweight and durable nature used to withstand harsh weather conditions such as rain and extreme heat or cold (Plastics, 2018). For its application, high-density polyethene would be used for the major components on Floatex, including the base of the unit, extended wings, side walls which hold the worm farm, the seats, storage bins and the shade pole holders. High-density polyethylene is resistant to mold and rotting and can be molded easily to various shapes and sizes, making it viable for the major components on Floatex (Plastics, 2018).

Aluminum

Aluminum was chosen as a material for its lightweight properties, recyclability and tensile strength in colder conditions. For Floatex, aluminum would be used for the glass holder pegs, touch screen display stand and the rods for the sunshade as the material provides an aesthetically pleasing color as well as durability to withstand wet weather conditions. Aluminum for the application of Floatex, can be recycled, adding to the sustainability factor of the Floatex design.

Powder Coated Aluminum

In addition to aluminum parts, the fishing rod holders, both top and bottom pieces developed for Floatex users, would be produced using aluminum, similar to the above stated parts, however, in order to achieve a variance in color, the rod holders would be fished using powder coated processes, allowing the metal to achieve the suggested colors, green or orange.

Plexi Glass

Plexiglass is a UV resistant material, which overtime does not gain a coloration of yellow unlike regular glass properties; this makes plexiglass an extremely viable material for the applications of Floatex, including its outer transparent panels as well as its transparent flooring for the base of the unit (Guo, 2019). Plexiglass is also a relatively cheap alternative and is a lightweight material, allowing Floatex to sustain an overall volume that is not as heavy (Guo, 2019).

Cordura Eco-Fabric (Nylon)

Cordura is an engineered fabric made from 40% recycled yarn and has water resistant capabilities that allow it to sustain itself during wet weather conditions (Cordura, n.d.). Cordura Eco- Fabric was chosen to be used on Floatex due to these properties and its sustainable aspects. The application for Cordura fabric would be used for the shade component developed for Floatex, allowing users to stay dry, providing shade from the sun and it is reliant as a durable material due to its tear resistant benefits (Cordura, n.d.).

Stainless Steel

Stainless when used for Floatex, would primarily be applied to parts that are stationary underneath the unit such as the motor shells which allow to move the unit as well as the

connector and receiver, designed for Floatex and allow of connectivity and modular capabilities between the units. These parts on Floatex are more susceptible to damage and by using steel as the material choice, it can effectively allow more durability and protection towards these units (Hornbacher, n.d.).

Manufacturing Processes

The manufacturing processes were chosen and understood based on the material choices of the parts that consist of Floatex. The below list showcases the manufacturing processes that will be used overall and correlate to table 8, in this section, which breaks down the entire material and manufacturing selection for each part of Floatex.

- Rotational Molding
- Blow Molding
- Injection Molding (Plastic & Metal)
- Aluminum Extrusion
- Metal Casting
- Powder Coating (Manufacturing Finish)
- Bulk Polymerization
- Fabric Spinning & Weaving

Technology

As further explained in section 5.6, under technology, Floatex uses autonomous capabilities in order to navigate on the water and allows for modular and connective capabilities using GOS modules, micro controllers and sensors (Matheson, 2019). This invention was introduced by MIT researchers and allows for autonomous units to connect to one another and analyze their surrounding in order to understand the possible movements that can be made (Matheson, 2019). This advancement in technology also suggests that units are able to latch onto one another; this is the premise of Floatex, as it is capable of using this upcoming technology in order to create floating docks that can be connected together and

allow users to either use the unit as a single moving device or connect to provide more space for members of a family, group or general recreational fishing outing (Matheson, 2019). Although Floatex uses autonomous capabilities to navigate on the water, it's connection through sensors and wiring also allows it to provide additional features such as the touch screen display, which allows users to navigate on the water using a 3D GPS system. However, this design concept is limited to the Floatex unit only and needs more analysis in order to showcase the interface applications of its navigational system (Matheson, 2019).

The chart below is a breakdown of the materials and manufacturing processes for the components of Floatex, as stated in the above sections.

Floatex Parts	Materials	Manufacturing Process
Base Structure	HDPE	Rotational Molding
Extended Wing Base	HDPE	Rotational Molding
Side Walls	HDPE	Rotational Molding
Storage Bins	HDPE	Blow Molding
Shade Pole Holders	HDPE	Injection Molding
Seat	HDPE	Blow Molding
Glass Holders	Aluminum	Aluminum Extrusion
Touch Display Stand	Aluminum	Metal Casting (Die cast)
Rod Holders (for shade)	Aluminum	Aluminum Extrusion
Fishing Rod Holders (Top & Bottom)	Aluminum & Powdered Paint	Metal Casting & Powder Coating
Floatex Receiver	Stainless Steel	N/A (Custom Part)
Floatex Connector	Stainless Steel	N/A (Custom Part)
Motor Shell	Stainless Steel	Metal Injection Molding
Sunshade	CORDURA Nylon	Fabric Spinning & Weaving
Glass Panels	Plexiglass	Bulk Polymerization
Glass Bottom	Plexiglass	Bulk Polymerization
Touch Screen Display	N/A	N/A

Table 8 – Material & Manufacturing Breakdown of Floatex

5.2.3 Manufacturing Cost Report

The below table demonstrates an estimated cost and breakdown of Floatex based on existing price points in the market. The prices chosen per part is subject to change based on relevancy and material, thus the overall manufacturing cost of Floatex, as shown below, is not a fixed estimate. The estimated manufacturing cost is also limited to available information and does not consider tooling, some electrical components, or startup molds for some of the mandatory parts.

Parts	Units	Cost / Unit	Total Cost (Low)	Total Cost (High)
Platform Base	1	$1500 - $3500	$1500 - $3000	$1500 - $3000
External Platform Wings	3	$350 - $600	$1050	$1800
Internal Wall Units	3	$150 - $300	$450	$900
Seat	3	$100 - $150	$300	$450
Storage Bins	3	$5 - $10	$15	$30
Motors	6	$150 - $300	$900	$1800
Fishing Rod Holder Top	2	$5 - $10	$10	$20
Fishing Rod Holder Bottom	2	$5 - $10	$10	$20
Touch Screen Display w/ Stand	1	$300 - $500	$300	$500
Glass panels	3	$200 - $300	$600	$900
Platform Connector w/ Electrical	1	$300 - $450	$300	$450
Platform Receiver w/ Electrical	2	$300 - $450	$600	$900
Glass Panel Holder	6	$3 - $10	$18	$60
Shade Holder	3	$10 - $25	$30	$75
Shade Poles	6	$25 – $75	$150	$450
Shade Cover w/ Velcro	1	$10 - $15	$10	$15
Final Cost:			$6,243 / Unit	$11,370 / Unit

Table 9 – Floatex Manufacturing Cost Analysis

5.3 Final CAD Renderings

Figure 5-1. Floatex On the Water

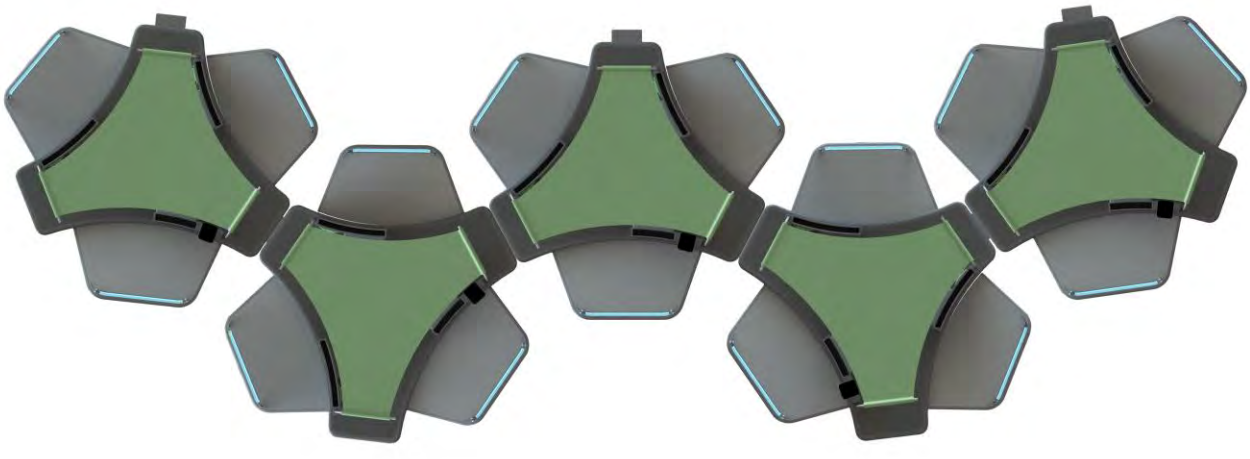


Figure 5-2. Possible Floating Dock Formation with Sunshades

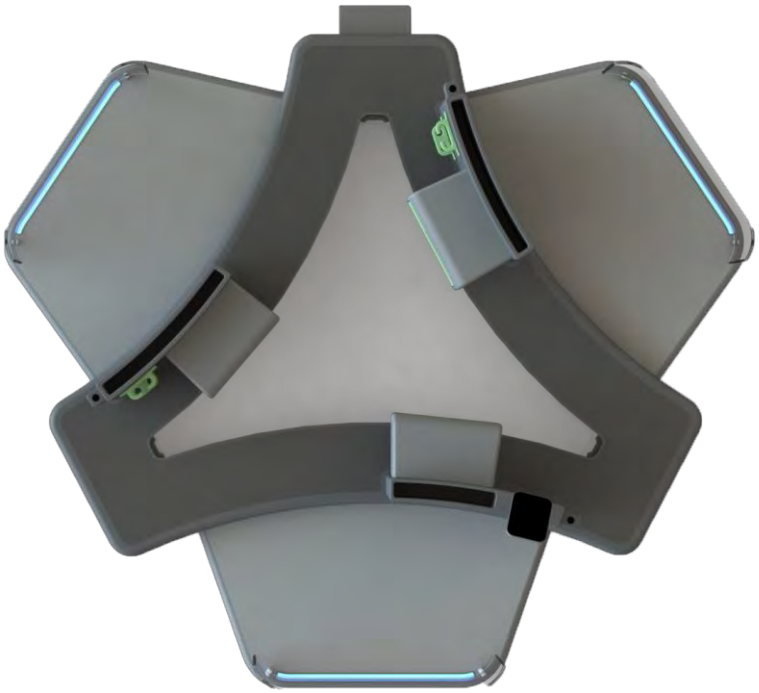


Figure 5-3. Top View of Floatex Without the Canopy

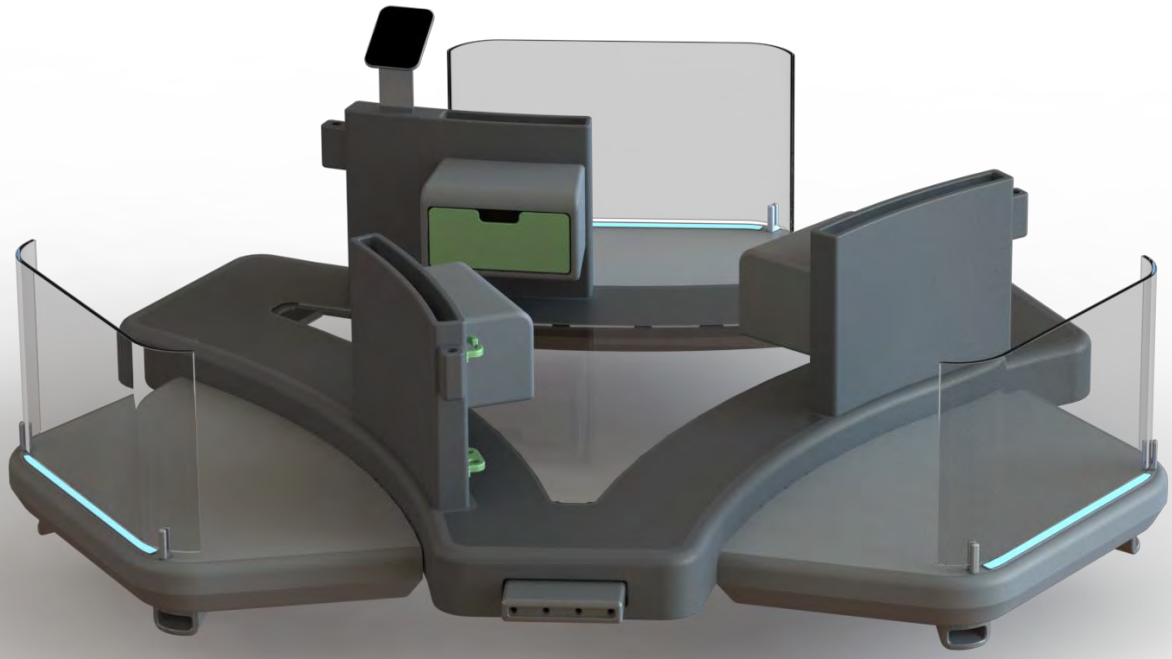


Figure 5-4. Complete Floatex Unit Without Sunshade

Figures 5-5 & 5-6. Touchscreen Display with Worm Farm

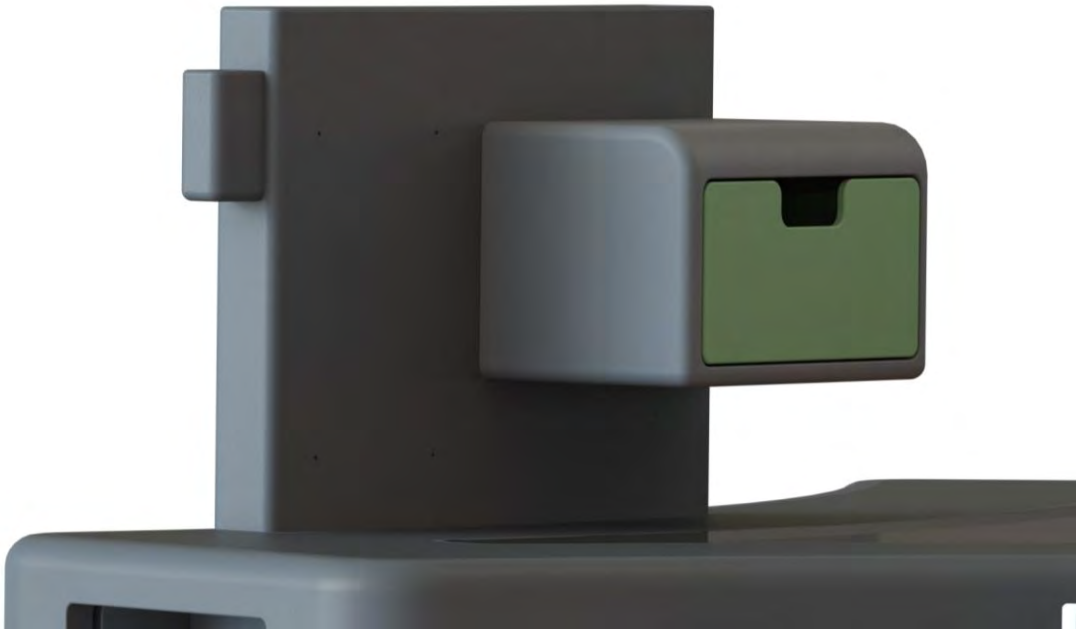


Figure 5-7. Seating with Storage Bins & Sunshade Rod Holder

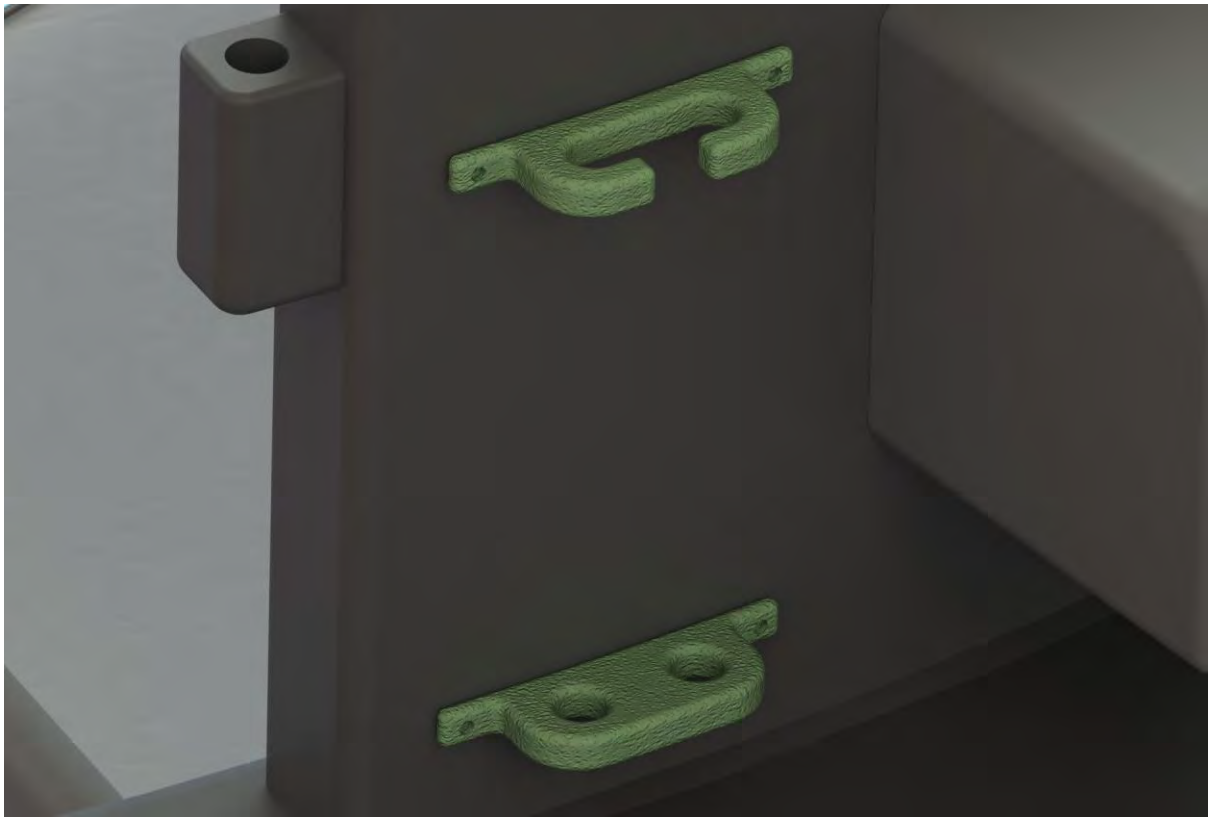


Figure 5-8. Fishing Rod Holders & Sunshade Rod Holder

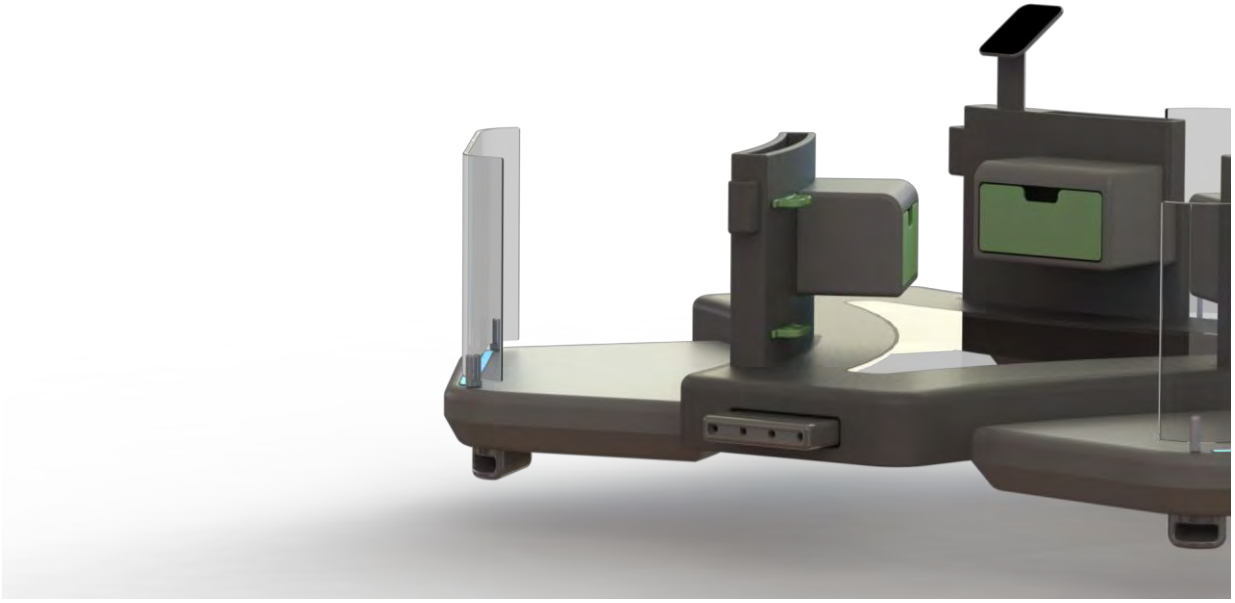


Figure 5-9. Floatex Side View with Connector & Glass Panels

Figure 5-10. Floatex Motor Design

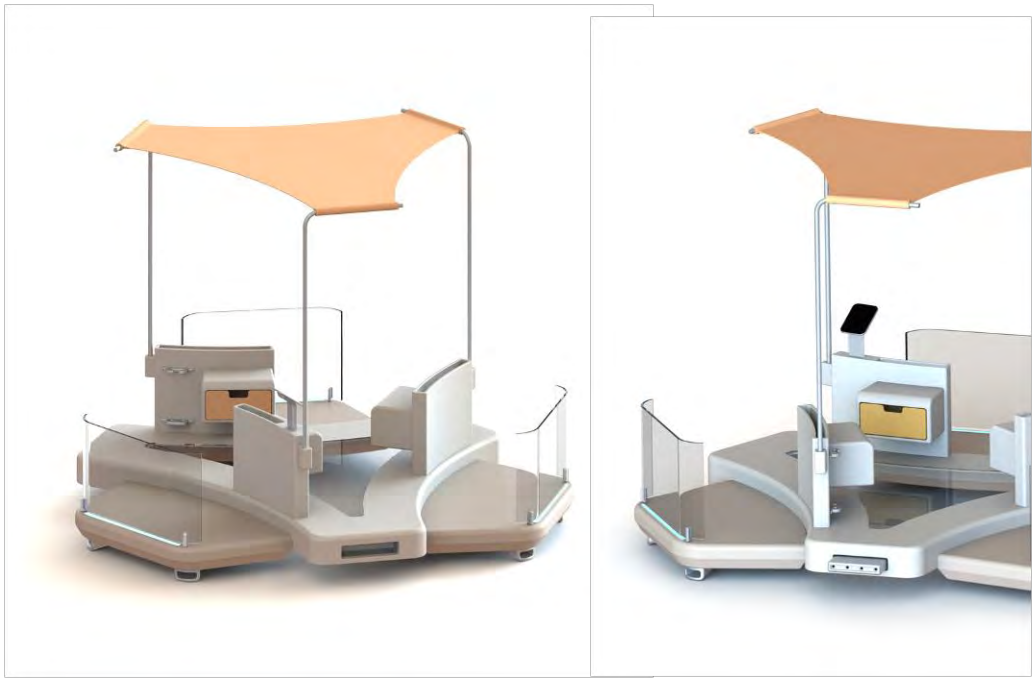


Figure 5-11 & 5-12. A Floatex Color Variation

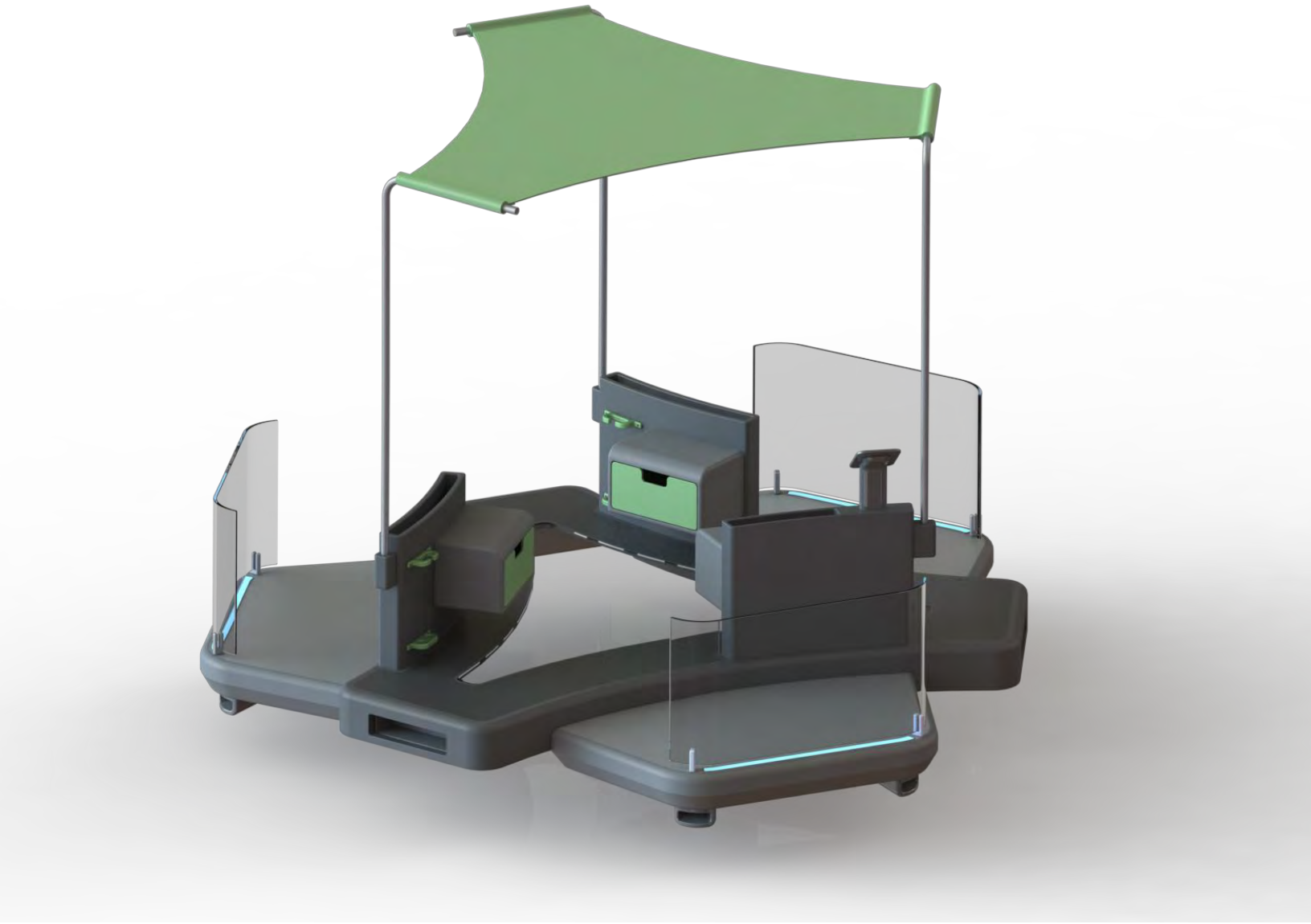


Figure 5-13. Full Floatex Unit with Sunshade

Figure 5-14. Floatex at Night with Lights

Figure 5-15. Floatex In the Evening without Lights

5.4 Hard Model Photographs

The following photos are of the Final Hard Model and show Floatex as a complete unit without the sunshade component.

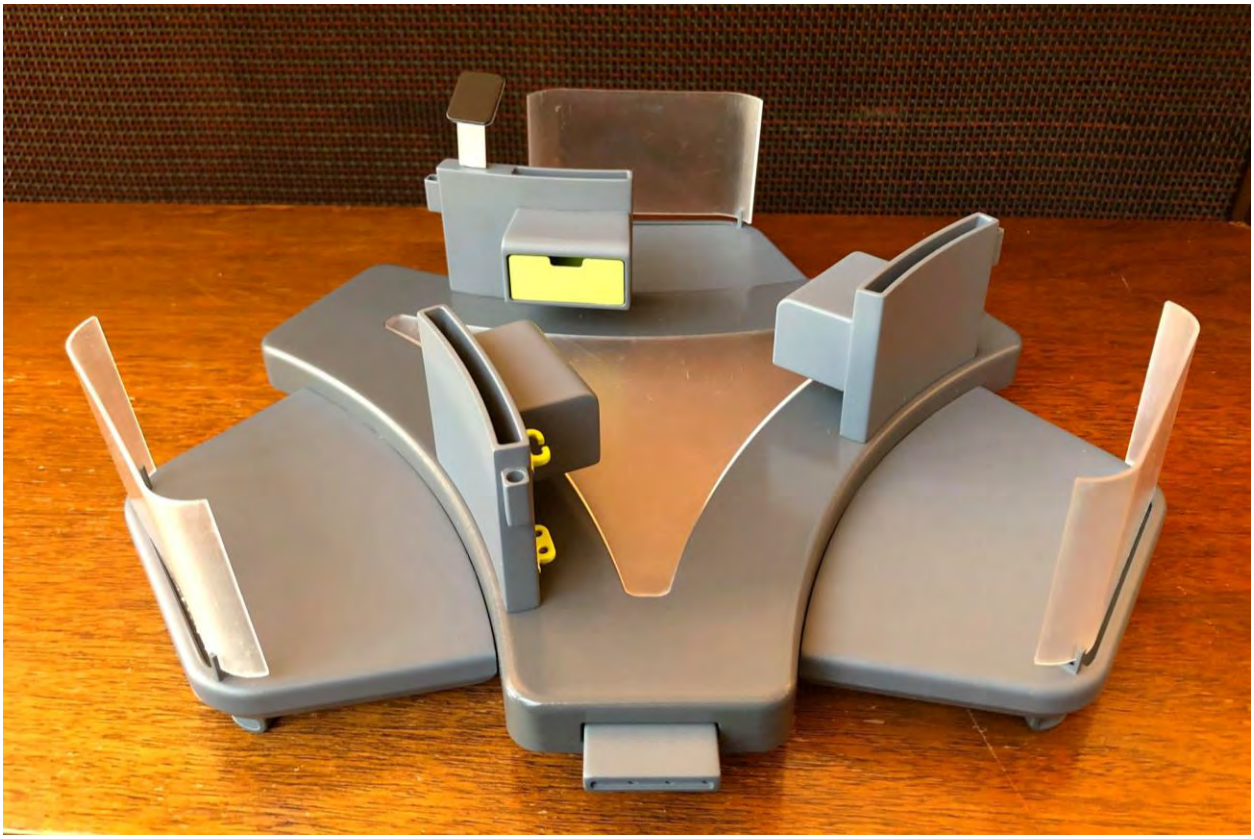


Figure 5-16. Full Floatex Model

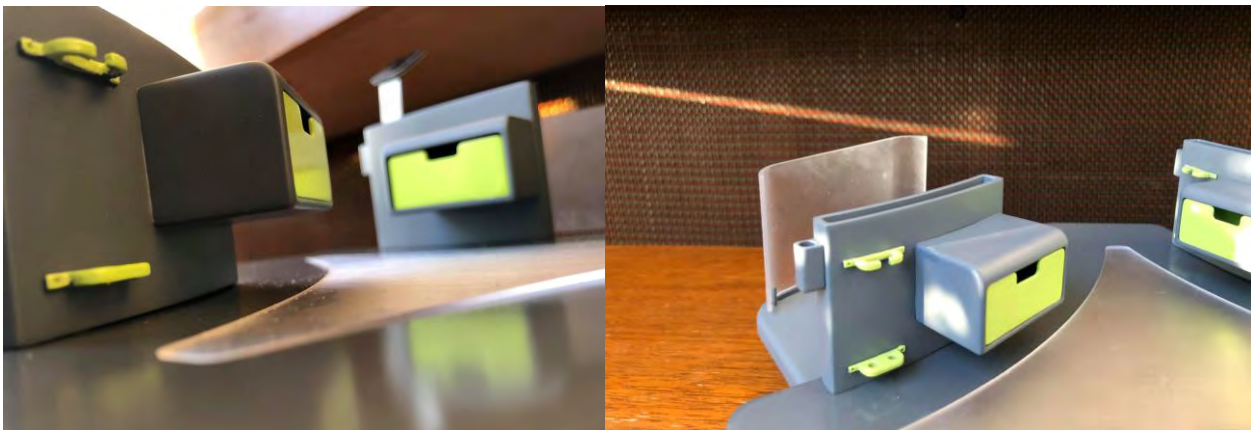


Figure 5-17. Hard Model of Floatex Seating

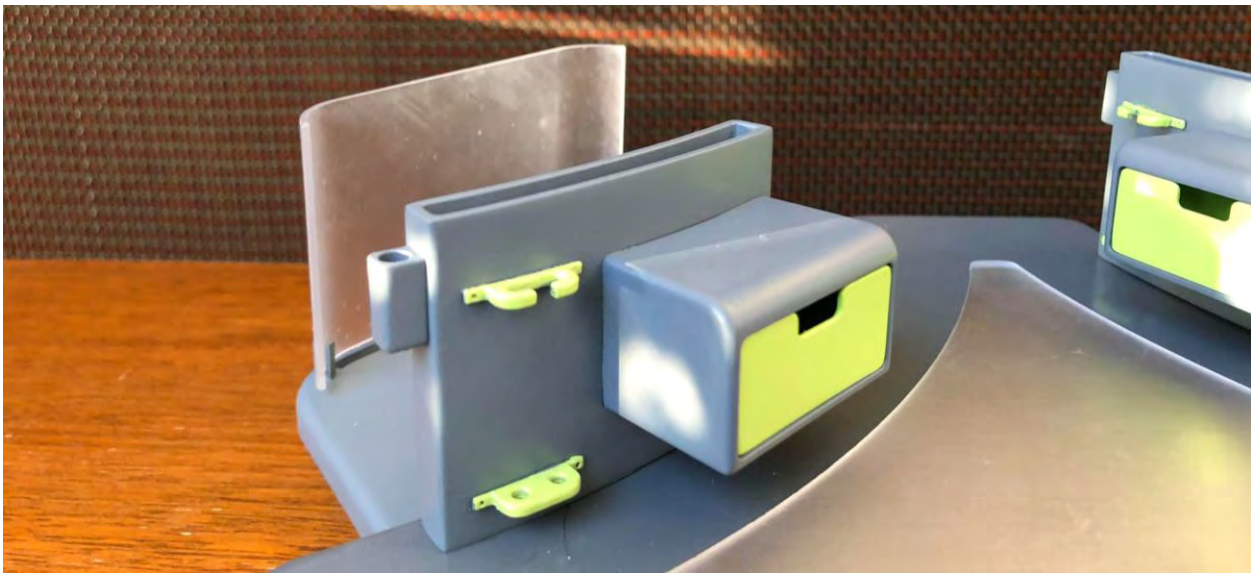


Figure 5-18. Closeup of the Floatex Model Fishing Rod Holders

Figure 5-19. Hard Model Photo of the Floatex Connector

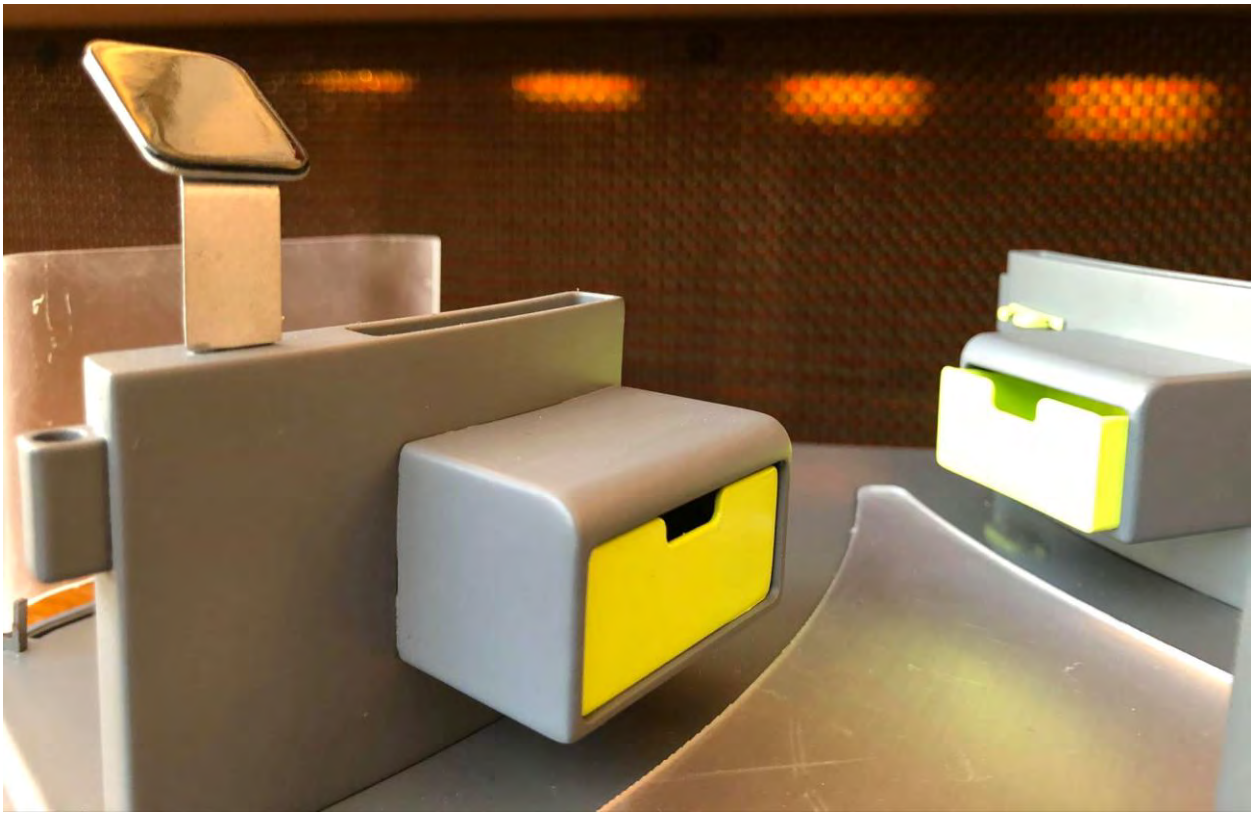


Figure 5-20. Hard Model Interior of Floatex

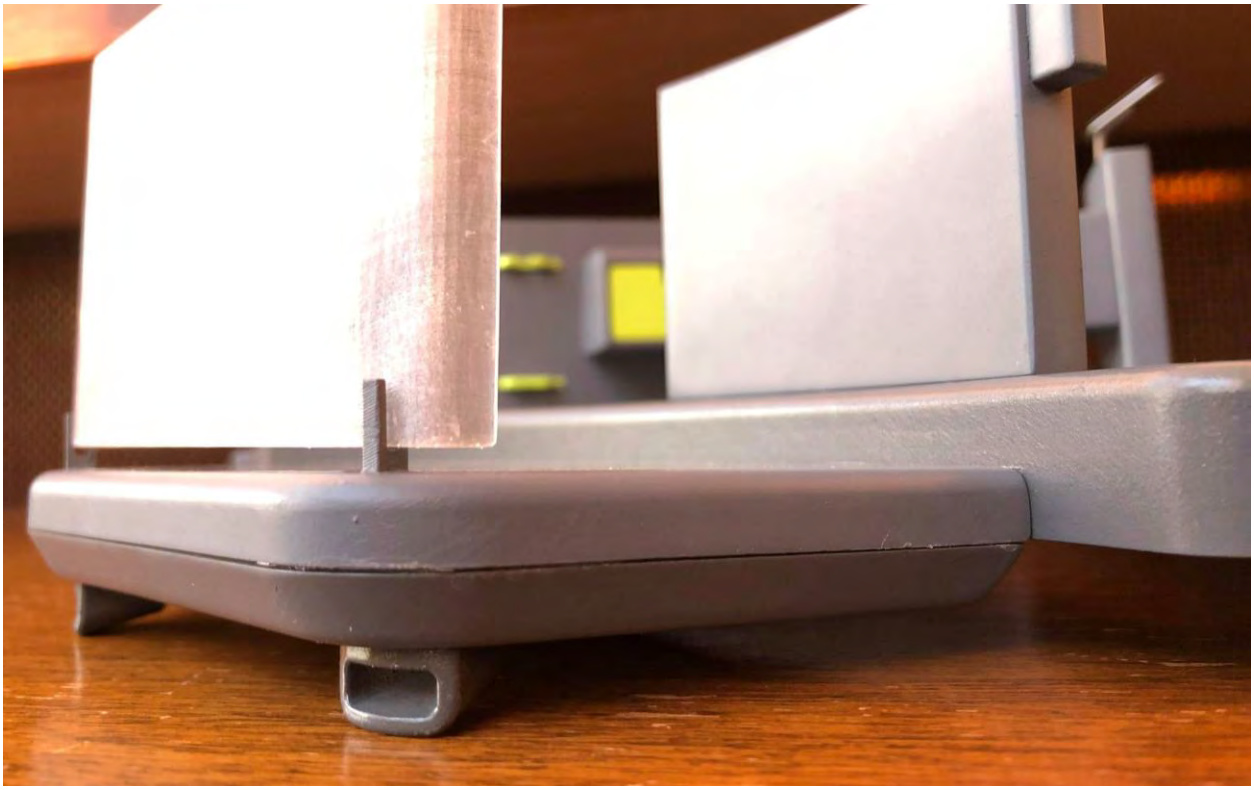


Figure 5-21. Hard Model of Motors & Glass Panels on Floatex

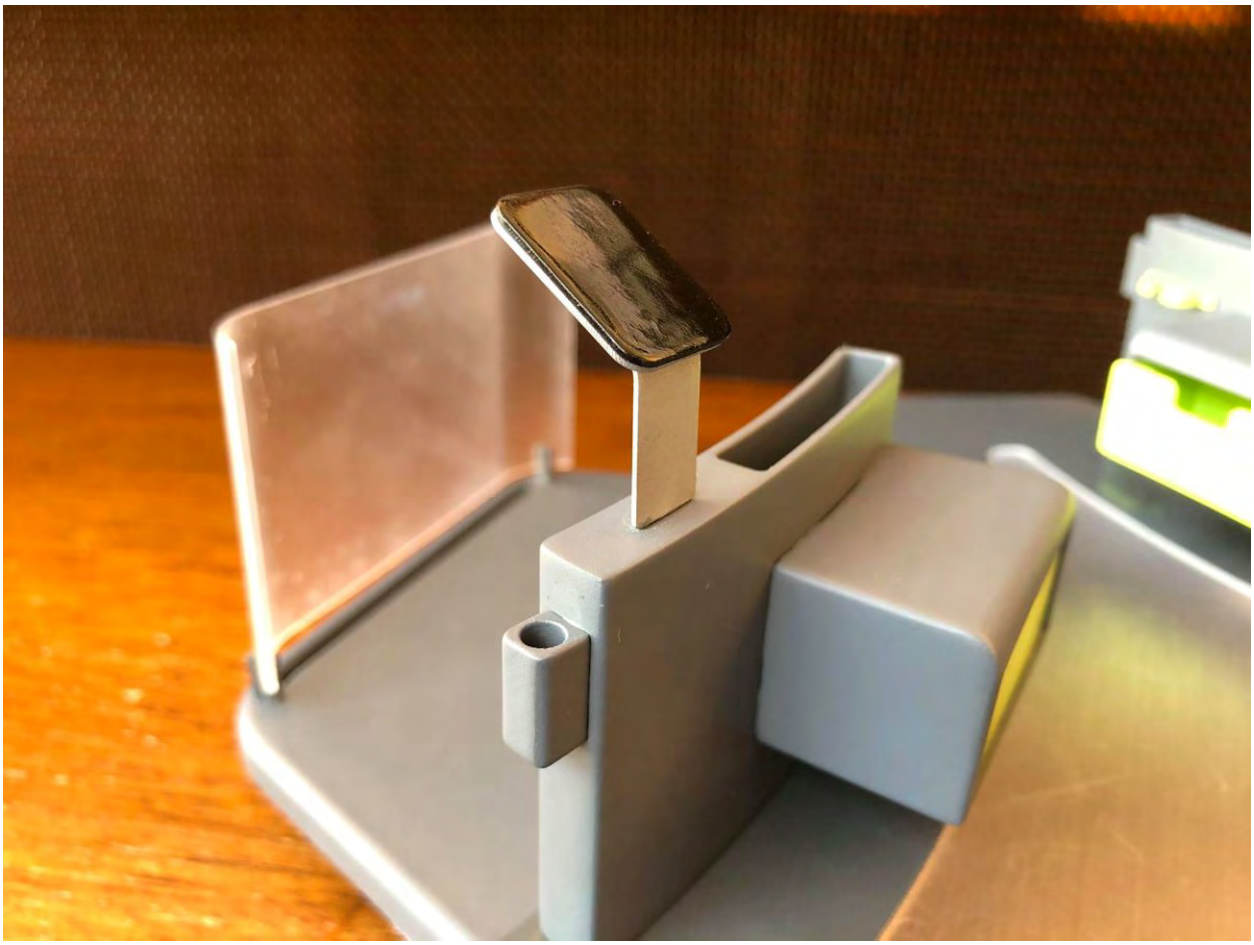


Figure 5-22. Hard Model of the Touch Screen Display

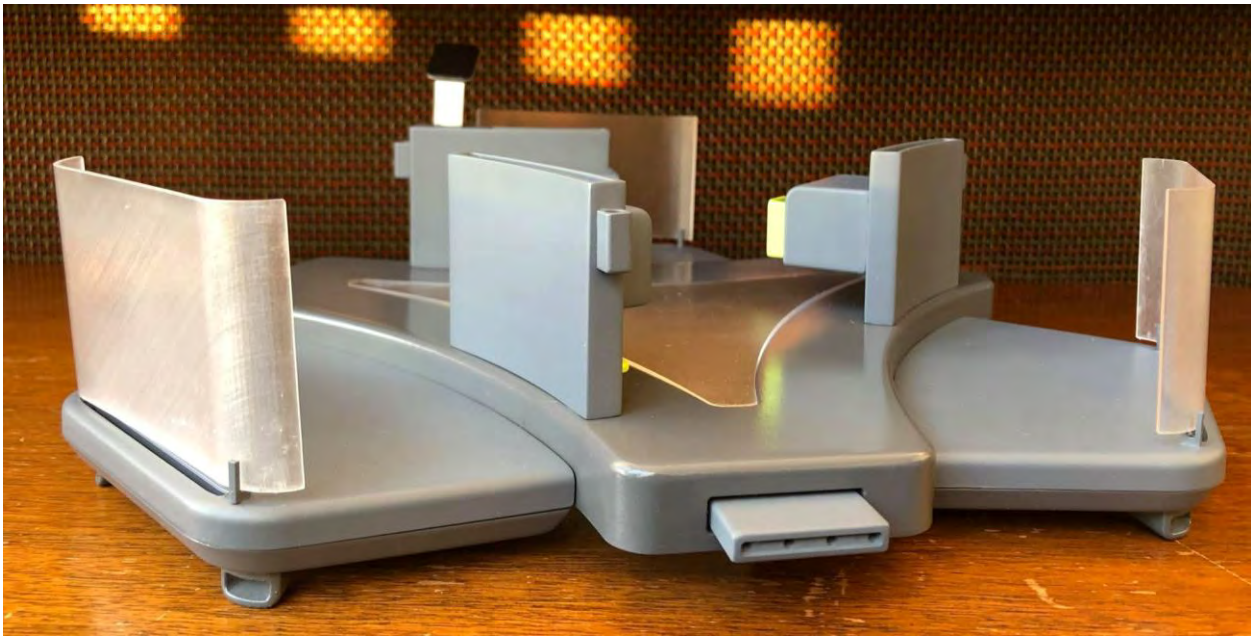


Figure 5-23. Side View of Floatex

5.5 Technical Drawings

Overall Floatex Measurements

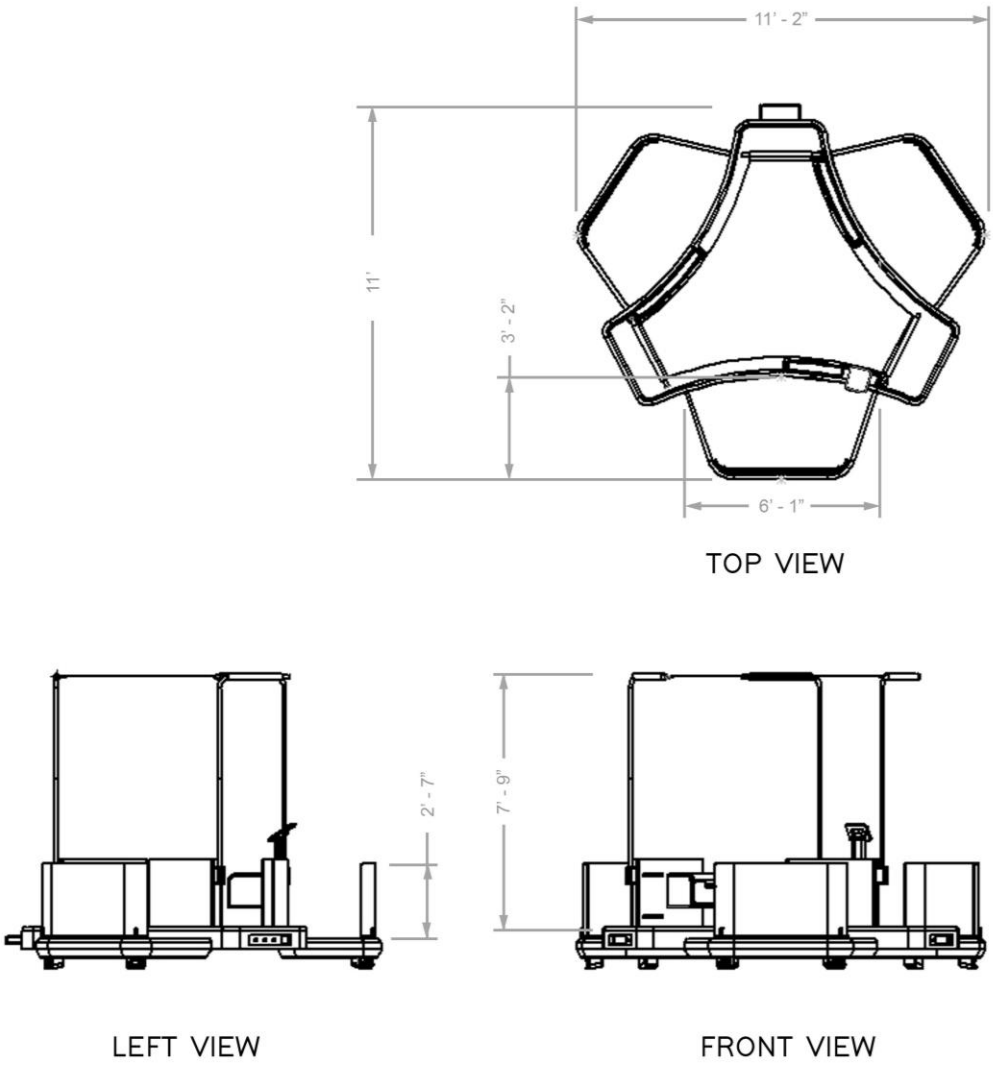


Figure 5-24. Technical Drawing of Floatex

Floatex Seating and Worm Farm Detail

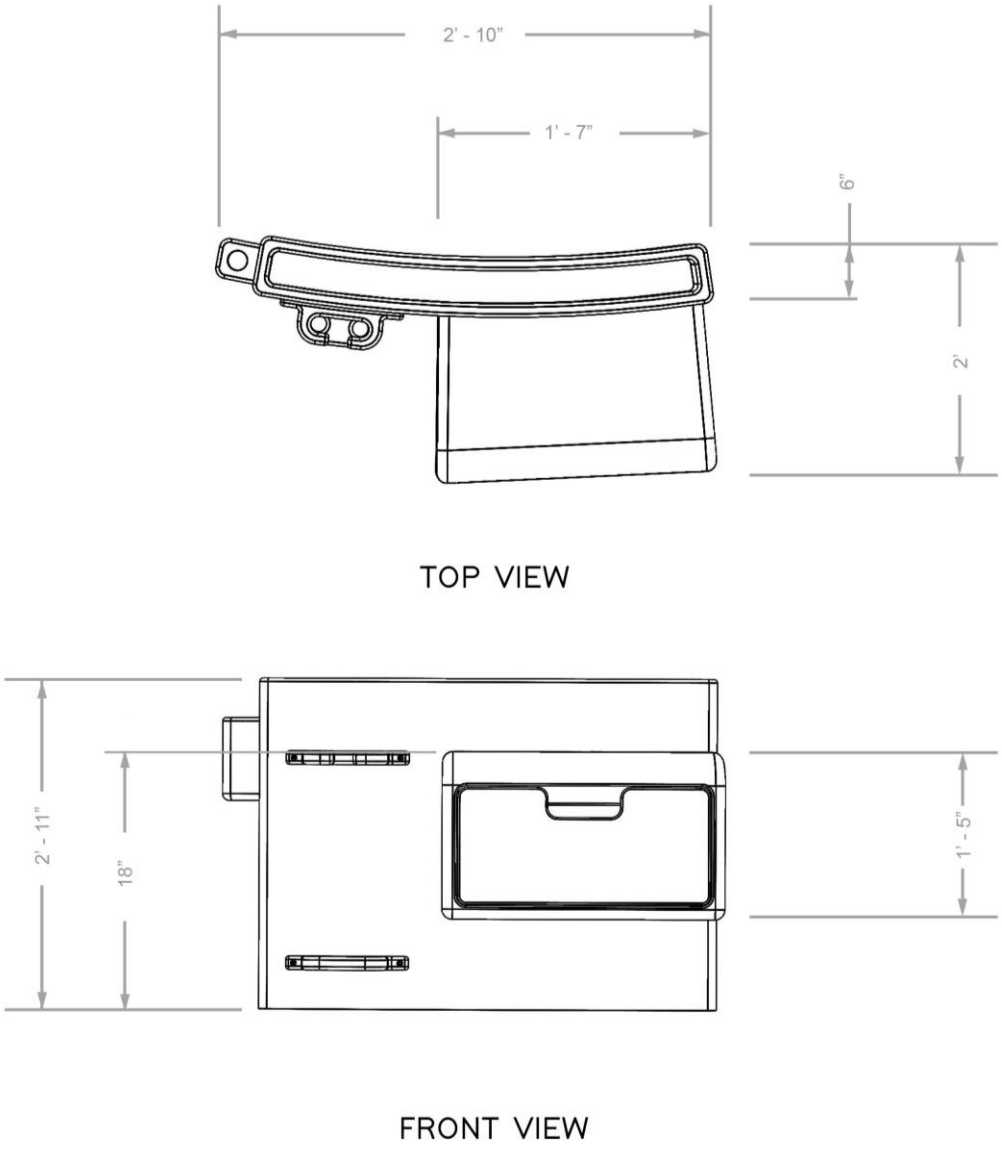


Figure 5-25. Technical Drawing of Floatex Seating

The above measurements shown in both technical drawings outline the main ergonomic aspects and features of Floatex relevant for user comfort. All measurements are in feet and inches and showcase the measurements for a 1:1 scaled ratio of the final design.

5.6 Sustainability

Floatex incorporates aspects of sustainability within its design through its choice of materials and development in mechanisms, allowing for the utilization of autonomous technology. Further discussed below, are the materials and power sources used by Floatex.

High-Density Polyethylene

High-Density Polythene is a durable plastic made from petroleum (HDPE, 2018). The material is resistant to rust and suitable for outdoor weather conditions including rain or snow, making it viable for the exterior elements of Floatex, including its base, molded seating elements, storage and additionally its internal structure (HDPE, 2018). In terms of sustainability, HDPE is considered environmentally friendly, since the end life of the material can be recycled and manipulated into composite wood or plastic lumber (HDPE, 2018). The manufacturing capabilities of High-Density Polyethylene include blow molding which will allow to create the exterior shape of Floatex (HDPE, 2018).

Cordura Eco-Fabric (Nylon)

Cordura Fabric is an eco-friendly material made from recycled polyester yarns (Cordura, n.d.). The fabric is resistant to tears and is suitable for outdoor weather conditions due to its water repellant capabilities (Cordura, n.d.). The fabric will be utilized for the seating shade that is housed on Floatex in order to protect anglers from weather conditions including rain or give shade to users during humid weather conditions (Cordura, n.d.).

Technology – Autonomous Capabilities

With the advancement in technology working to be developed for watercrafts, Floatex incorporates autonomous capabilities with the use of robotic GPS modules, micro-controllers and sensors which allow each individual unit to connect to one another without the use of

human assistance (Matheson, 2019). The sensors and mechanisms housed in the electrical unit of the platforms body, allows for the unit to navigate its connector into the latching mechanism, connecting units together to form large floating docks which can be further attached to or detached if a single unit is needed (Matheson, 2019). This technology was first introduced by MIT researchers and has the capability to be utilized with Floatex in order to generate opportunities for modern fishing practices (Matheson, 2019). The combination of these technologies, allow for an ecofriendly unit due to the electrical powering system that will be integrated within the unit, eliminating the use of gas and potential for oil leaks in the water.

6 Conclusion

Floatex is a **modular recreational fishing unit** designed to provide fexibility for general fishing enthusiasts, the public and families and promotes the sport of fishing for upcoming generations through its modern design elements. Floatex encorporates seating, lighting, provided worm farms, storage, coverage from weather and autonomous capabilities, in order to sustain an ease of use for the overall unit. Floatex as a solution and newly developed opportunity for the fishing industry, mitigates user fears, promotes sustainability and nonetheless enhances the recreational fishing experience.

Figure 6-1. Floatex Units in Use

References

Aalco - Ferrous. (2019). Aluminium - Specifications, Properties, Classifications and Classes. Retrieved from https://www.azom.com/article.aspx?ArticleID=2863

Alvin R. Tilley, & Henry Dreyfus Associates. (2002). *The Measure of Man and Woman; Human Factors in Design* (Revised Ed). John Wiley and Sons, Inc

Ben, H. (2016). *Stacked Boats*. [Digital Image]. Retrieved from https://unsplash.com/photos/4W92z8cNQ_c

Cordura. (n.d.). Retrieved from https://www.cordura.com/Fabrics/eco-fabric

Cooke, S. J., & Cowx, I. G. (2004). The role of recreational fishing in global fish crises. *Bioscience, 54*(9), 857-859. doi:http://dx.doi.org.ezproxy.humber.ca/10.1641/0006-3568(2004)054[0857:TRORFI]2.0.CO;2

Dow, L. (2015). [Digital Image]. Lake George. Retrieved from https://www.lakegeorge.com/whatsnew/2015/06/lake-george-most-beautiful-lake/

Drowning In Canada. (2000). Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1231392/pdf/cmaj_162_13_1867.pdf'

Dudkiewicz, I., Salai, M., Blankstein, A., & Chechik, A. (2000). Fishing Penetration Injuries. Retrieved from https://bjsm.bmj.com/content/34/6/459.full.

Farrow, P.H., Johnson, R.R., & Larson, A. L. (2000). Entrepreneurship, innovation, and sustainability strategies at walden paddlers, inc. *Interfaces*, 30(3), 215-225. doi:10.1287/inte.30.3.215.11660

Fisheries and Oceans Canada. (2019). Retrieved 25 September 2019 from http://www.dfo-mpo.gc.ca/stats/rec/canada-rec-eng.htm

Fisherman Silhouette on White Vector Image. (n.d.). [Digital Image]. Retrieved from https://www.vectorstock.com/royalty-free-vector/fisherman-silhouette-on-white-vector-21938018

Giles, M. (2015). Boat Ropes. [Digital Image]. Retrieved from https://unsplash.com/photos/08b4awIHtBA

Gomez, F. (n.d.). Synapse Lighting. [Digital Image]. Retrieved from https://www.pinterest.ca/pin/406731410068607291/

Guo, A. (2019). The Pros and Cons of Acrylic. Retrieved from https://www.pwdshop.ca/blogs/blogs/the-pros-and-cons-of-acrylic

HDPE, What is it and what is it used for? (2018). Retrieved from https://areteindustries.us/hdpe-plastics/

Hornbacher , A. (n.d.). Steel versus Aluminum Weight, Strength, Cost, Malleability Comparison. Retrieved from https://www.wenzelmetalspinning.com/steel-vs-aluminum.html

Hyra, R. (1978). Methods of assessing instream flows for recreation. Retrieved from https://books.google.ca/books?id=UPbX_7nKjCoC&dq=safety+requirements+for+recreational+fishing+boat&lr=&source=gbs_navlinks_s.

Interlocking Shapes. (n.d.). [Digital Image]. Retrieved from https://www.pinterest.ca/pin/392868767473526999/

Kappen, D., Thomson, B., & Burke, P. (2018). Industrial Design Thesis Terminologies: Full Bodied Human-Interaction Design. In *Industrial Design Thesis Terminologies* (pp. 1-3). Toronto.

Lake Water Reflection. (n.d.). [Digital Image]. Retrieved from http://pdpics.com/photo/499-lake-water-reflection/

Lifesaving Society (2016). *Canadian Drowning Report.* Retrieved from http://www.lifesavingsociety.com/media/241812/canadiandrowningreport_english_web.pdf

Matheson, R. (2019). MIT's fleet of autonomous boats can now shapeshift. Retrieved from http://news.mit.edu/2019/roboats-autonomous-connect-assemble-0829

Nancy Hofmann. (n.d.). Retrieved 25 September 2019 from https://www150.statcan.gc.ca/n1/pub/16-002-x/2008002/article/10622-eng.htm#archived

Olimb, J. (n.d.). Man Sitting and Eating a Burrito Silhouette – Stock Image. [Digital Image0. Retrieved from https://www.gettyimages.co.uk/detail/illustration/man-sitting-and-eating-a-burrito-silhouette-royalty-free-illustration/509342924?language=fr

Plastics, P. (2018). High Density Polyethylene (HDPE): So Popular. Retrieved from https://www.plasticsmakeitpossible.com/about-plastics/types-of-plastics/professor-plastics-high-density-polyethylene-hdpe-so-popular/

Policansky, D., Ostrom, E., Goldstein, B. D., Norgaard, R., & Burger, J. (2001). Protecting the commons A framework for resource management in the Americas. United States: Island Press.

Roblin, A. (2014). Bladeless Boat Engines. [Digital Image]. Retrieved from https://www.trendhunter.com/trends/air-booster-motor

Seth, R. (2014). Radhika Seth. Retrieved from https://www.yankodesign.com/2014/03/28/boat-blade/.

Silhouette of a Person Fishing. (n.d.). [Digital Image]. Retrieved from https://www.pngitem.com/middle/TJJTox_fisherman-fishing-silhouette-photography-hobby-silhouette-of-a/

2018 Special Report on Fishing. (n.d.). Retrieved 23 November 19 from https://outdoorindustry.org/wp-content/uploads/2015/03/2018-Special-Report-on-Fishing_FINAL.pdf

2005 Survey of recreational fishing in Canada: Selected results for Ontario fisheries (2009). Ontario Ministry of Natural Resources. Retrieved 23 November 19 from https://www-deslibris-ca.ezproxy.humber.ca/ID/221956

UltraSkiff 360. (n.d.). [Digital Image]. Retrieved from https://www.thisisbrainy.com/ultraskiff-360-is-the-fishing-platform-everyones-waiting-for/

Wheeebo. (2020). [Digital Image]. Retrieved from https://www.yanmar.com/global/news/2020/01/07/67221.html

Appendix

Appendix I – Discovery

User Interviews

Background:

Interviewee 1: Trevor Seekumar

Age: 31 years of age

Contact information: Udealfurniture@gmail.com

Basis of expertise: Interior Decorator

Transcripted Interview:

The researcher and the interviewee met on October 6th, 2019, at the interviewees home. The researcher explained the scope of the project, purpose, procedures and confidentiality for the interviewee, stated in the information and consent forms. The tone of the interview was informal and was recorded through the means of listening and typing, with an occasional reiteration for the interviewee in order to ensure the researchers information collection was accurate.

Interview 1:

User Profile:

1. What motivates you to practice recreational fishing?
    a. Catching fish and being one with the wilderness. I get to go outdoors and there's nothing like man and nature

2. What do you enjoy most about the sport?
    a. It's all about the chase and you also get to be on the water and it's an awesome feeling. Even when you're on a boat, on the lake, it's a thrilling experience.

3. How often do you go fishing?
    a. I go fishing approximately once every two months

Needs:

4. Are there any popular benchmarked products that are used for fishing?
    a. There are Shimano reels, speed boats and Mercury motors.

5. What are some of the needs that anglers or fishing enthusiasts require in crafts?
    a. On boats they require fishing rod holders, radars, seats if you're driving, however the ideal item would be a platform that is flat in order to cross in and out of your boat safely. Most of the time I like to stand, I would want a standing platform as well as a fish cooler.

User Experience:

6. If any, what activities do you typically conduct in order to pass time while fishing?
    a. When on a craft I enjoy playing cards, eating and drinking. When I'm on the shore I enjoy cooking, keeping campfires and swimming.

7. On average, what is the group size that accompanies you?
    a. On average, I go with my family which consists of 3 individuals including myself. Occasionally other individuals will join this group and numbers become as large as 6 to 7 people.

8. How might new technology be integrated to better the fishing experience for anglers?
    a. Some ideas that come to mind are a radar that detects the heat sense of fishes for more accuracy.

9. How might the weather or environment challenge your fishing experience?
    a. Most weather conditions don't allow you to get out on the water due to dangers such as lightening or heavy rain.

Safety:

10. What are the safety concerns that you have when fishing from a craft?
    a. The boat tipping over during rough tides. Also going too far and running out of gas. When things like this happen, you don't have access to fast help and there is a fear of being stranded in a place that doesn't allow for help to be accessed or made aware.

11. What injuries have you undergone while practicing the sport?
    a. Getting pricked by hooks and cut by lines. There is a space limitation and your balance is not stable all of the time. In that case, accidents do happen.

Key Points

The key aspects that were observed by the interviewer include:

1. Weather played a big role in weather or not the participant could enjoy their activity venturing the waters. Heavy rain and thunder are conditions that limit the participant.

2. Stability is an issue that aids in the participant getting injured; usually by being pricked from the hook or almost falling overboard.

3. The average group size is around 3 to 7 people

4. Other activities enjoyed by the participant included, playing cards and listening to music, however, the enjoyment of being outdoors was favorable over their needs of other activities.

5. Getting access to help fast was also an issue for the user; this is an in the case that user ran out of gas and or was stranded in a place that could not be easily located by other individuals.

Background:

Interviewee 2: Michelle Muthu

Age: 35 years of age

Contact information: Michellemuthu@gmail.com

Basis of expertise: Program Co-ordinator at the Canadian Cancer Society

Transcripted Interview:

The researcher and the interviewee met on October 9th, 2019, at the interviewees home. The researcher explained the scope of the project, purpose, procedures and confidentiality for the interviewee, stated in the information and consent forms. The interview was recorded with the interviewees consent and information was also collected through the means of typing.

Interview 2:

User Profile:

1. Can you give me a brief synopsis of your last fishing experience?
    a. It was amazing; I went to a lake and I was fishing off the dock. The water had a high tide and it was a rocky area and very slippery. It was also a sunny summer day and the atmosphere was not busy and I went with my family. There were approximately 6 people with me, and I was lucky enough to have caught a large bass fish.

2. How often do you fish from a craft or boat?
    a. Three times a year, more or less, depending on my availability.

Benchmarked Products:

3. What limitations do you have with current recreational fishing crafts?
    a. When I'm on a boat, there is usually more than one person and it's hard to move around. The boat is very rocky and it's hard to keep balance depending on the water. Casting is also very challenging, and you can get tied up with other fishers and your line gets caught in the weeds. The anchor is also hard to pull up and gets buried in weeds

4. What concerns do you have with current fishing crafts/boats?
    a. They have a limited amount of gasoline which only lasts so long. Also, the engine is not powerful enough on rental fishing boats used when I go recreational fishing.

User Experience:

5. Are there any strains or hassles that you face while fishing from a craft?
    a. Yes, it's hard to pull in a fish with stability and there is a risk of falling over the boat.

6. If any, what additional activities would you like to participate in while fishing?
    a. For the most part, I enjoy the naturalness of the waters, sounds and overall fishing atmosphere. If anything, music and games are something I would enjoy with a group of people while fishing.

Ergonomics:

7. What user ergonomic interaction might anglers or fishing enthusiasts have while fishing from a craft?
    a. People who fish interact with the seat for relaxing, but they are uncomfortable, and limited to one position. You also stand but don't have room to move around.

Safety:

8. If any, what safety gear do you wear while fishing?
    a. Life jacket, gloves and rain boots.

Aesthetics:

9. What future improvements do you see being made for anglers?
    a. In the future I see modular boats that can be enclosed and allows you to fish from the inside of an enclosed space. Decks on boats can also be added in order to be closer to the water and perhaps better washroom situations since it is difficult to use the washrooms while fishing, other than in the case that you own a boat with a bathroom. These are far too expensive for the average recreational fishing family and often, people like me rent boats.

10. How would you like technology to be innovated in future craft designs?
    a. The boat has a sensor that tells you when fishes are around the boat.

Key Points

The key aspects that were observed by the interviewer include:

1. When asked about technology integration, the interviewee had thoughts, however, it was not as heavily focused and their connection between nature and relaxing played an importance.

2. Stability and safety were a key issue for the participant, especially due to space limitations in existing boat designs.

3. There are limitations to movements and the participant is stationed to sitting

4. Basic needs such as using the restroom was explained to be difficult; although this is addressed today through developed boat designs, basic needs are not made available for the general public through rental boats.

5. Strains for the user also included features on benchmarked products such as the anchor.

Appendix II – User Research

User Profile Report

Age & Gender:

"In 2015, for example, 42% of Canadian anglers were in the 45-64 age group" (Fisheries and Oceans Canada., 2019)

"Male anglers made up 79% of all resident anglers, 81% of Canadian non-resident anglers and 76% of all other non-resident anglers" (Fisheries and Oceans Canada, 2019)

"Typically, anglers tended to be baby boomers. Male anglers were typically older than female anglers. Nationally, the average male angler was 48 years old, whereas female anglers were on average four years younger" (Nancy Hofmann, n.d.)

"In general, children, ages 6 to 12, participated in fishing at a higher rate than teenagers" (2018 Special Report on Fishing, n.d.)

Frequency Summary

On average a total of 5-7 hours was spend fishing by anglers; this number varied from individuals who are resident and nonresident individuals. More time was spent fishing when anglers were on boats, with a percentage of 77% compared to the 23% that did not (2005 survey of recreational fishing in Canada, 2019)

Motivation and Lifestyle

Recreational fishing trips consist of 2-3 individuals for age groups older than 18. Individuals who participate in recreational fishing live a conservative and active lifestyle. According to the research, the top motivations for recreational fishing included spending time with the family (73%) and Spending time outdoors (70.5%) (2018 special report on fishing, n.d.).

Income Level

Since individuals who participate in recreational fishing varies, the income levels can be justified by figure 3 which suggests that the average individual who participates in fishing make an income of $50 - $75,000; this allows them to buy gear and equipment for their practiced activity.

Location:

The most popular locations for recreational fishing according to a 2018 study included shorelines, boats and riverbanks (2018 special report on fishing, n.d.)

Demographics

Overall, Canadian recreational fishers tend to be older males, and Caucasian. The demographic distribution is bimodal: under 20 and 40-65

- The under 20 group tend to be low frequency participants and are supported by parents or other, and have less experience, participating in fishing as a general hobby.
- The 40-65 recreational fishing demographic are high frequency participants and are much more experienced with a mid to high income range. These individuals are independent and have access to tools, gear, and other necessities that are more advanced for sport fishing practices.

User Behavior

The user behavior of recreational fishers who average between the majority which is 40-65 years old fish approximately 13 times a year at a rate of 5 – 7 hours per trip. Experienced recreational anglers' fish in locations with remote bodies of water including shorelines and lakes and often utilize boats instead of dock residing to dock fishing.

Primary, Secondary, Tertiary Users:

Primary User: General Public

Secondary User: Inexperienced Angler

Tertiary User: Expert Sports Angler

Demographics		**Use Behavior**		**Personality**		**Cognitive aspect**	
Age	40-65 <20	**Frequency of use**	Average of 13 times per year	**'locus of control'**	↑	**Technical Skill**	↑
Gender	Mostly male (~79%)	**Duration**	Between 5-7 hours per fishing trip	**Self-efficacy**	↑	**Pre-req. content knowledge**	--
Culture / Ethnicity	Predominantly Caucasian	**Social/Solitary**	Mixed	**Changeability**	---		
Income	<20: low income 40-65: $50 - $75,000+	**Level of Focus**	40-65: High <20 low	**Uncertainty Avoidance**	---		
Educational Bkgd	Mixed between individuals (foreign and native schooling)	**Location**	(outdoors) Lakes, boats and shorelines				

Persona

Name: Bob Bennet
Age: 46
Job: Industrial Design Professor
Income: $65,000

Education: University graduate
Relationships: Married
Location: Toronto, ON

Main hobby: Recreational Fishing
Frequency: Late summer
Duration: 6 hours per trip
Social: With friends & spouse

Other Pursuits: Relaxed lifestyle
Cooking
Gardening

Figure 8-1. Real fishing magazine, Bob Izumi, Retrieved Sept 25, 2019 from https://realfishing.com/magazines/real-fishing-magazine-winter-2018/

Profile:

Bob Bennet is a 46-year-old Caucasian individual who has worked as an Industrial Design Professor for over 6 years. Bob has graduated from University with a PhD and is happily married for over 30 years to his wife. Fishing has been a long-time family outing for Bob since he was a child and has become more experienced with various fishing practices and tournaments over the years. Bob actively joins fishing tournaments in Ontario.

User Behavior:

Bob enjoys fishing with a group of 2-3 close friends, including his wife and like to fish during the end of summer when waters are much cooler and fish sizes have increased. On average, Bob spends 6 hours fishing and tries to enjoy his hobby 12 times in a year.

Nonetheless, Bob owns a 14" tracker boat which allows him to cover waters in order to increase catch rates. He regularly buys tackle and rods, improving his style and fishing techniques. Bob usually enjoys Bass fishing around weedy shorelines, however, he occasionally practices fly fishing.

User Observation Report

Preliminary Video Observation:

URL: https://www.youtube.com/watch?v=iPz81RAlqQE

Title: Camping and Fishing Trip with the Family

Length: 40:01

Brief Description

The video is of three adults and one child practicing a recreational fishing trip on a body of water. The individuals are vlogging their fishing experience which includes them getting in and out of the boat, casting and using gear to retrieve the fish.

Relevance to Thesis Topic

This video is shows relevant information with regards to the thesis topic since it shows a family of 4 individuals practicing recreational fishing on a body of water, allowing for an observational study that showcases the user problems.

Video: Steps and Analysis

Step 1: Set up gear on shore, including the line through the rod

Step 2: Enter the small tracker boat which is stationed on a shallow body of water

Step 3: Man casts the line out into the water using a fishing rod

Step 4: Waits for catch

Step 5: Women retrieves rod and reels in fish

Step 6: Secondary women, grabs a large net to securely catch the fish (teamwork)

Step 7: Start engine, and sail the waters

Step 8: repeat steps 2 to 6 throughout the day until dark

Step 9: Cook and eat fish on shore

Video Analysis

The video gives insight to humanistic experience concerns while the family was fishing; this includes, balance and stability and space restrictions. At 27:03 it can be noted that the male individual struggles to get onto the boat even whilst it is stationed partly on shore, balance and stability was a key issue. During 14:08 the setting of the environment changed from day to nighttime fishing which proved hard for the family to see, as they resulted in using a flashlight. Nonetheless the demographic was equal with 2 males and 2 female figures.

Direct User Observation

About the Users

The anglers presented in this observational study were limited to dock fishing due to weather conditions, and boat problems encountered during the cold season. The observation includes two male participants who were fishing together and was studied in the area of Barrie, Ontario.

Name: Carlos. M
Age: 59
Sex: Male
Fishing Activity: Twice a month
Type of Fishing: Dock Fishing
Date of Observation: 11/03/19

Name: Joseph. P
Age: 21
Sex: Male
Fishing Activity: Once a month
Type of Fishing: Dock Fishing
Date of Observation: 11/03/19

Chronology of Observation

STEP 1: Setting up the gear

- The angler first organizes his gear which includes fishing rods, and selected tackle that is implemented on the rod
- Additional gear included tackle boxes filled with lures such as crank baits, spoons, and soft baits, however, live worms were also carried

STEP 2: Adding bait to the hooks

- The anglers added the live bait to the hooks using their hands, no gloves were utilized
- Comfortable clothing was warn, with resepct to the weather (hail, rain)
- Anglers mentioned that worm boxes easily fly away with wind and not all worms are used

STEP 3: Finding a location

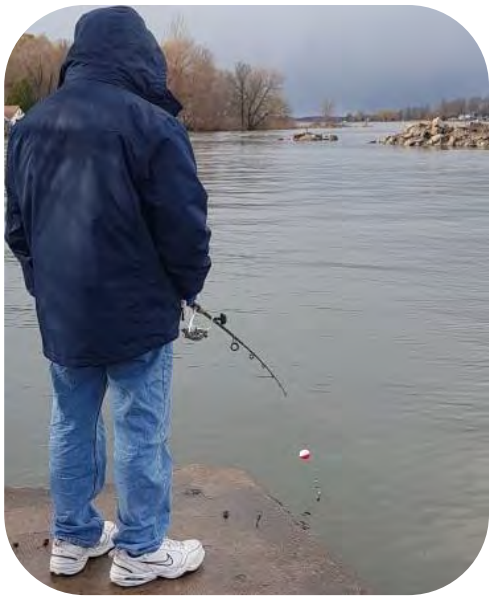
- The anglers looked for a location away from weeds and rocks to avoid getting stuck when casting
- Anglers expressed that dock fishing limits the area that can be covered when casting and limits catch rates for fishing

STEP 4: Casting & waiting

- The anglers casted their lines into the open waters
- Wait times for bites were 5-minute intervals before casting again

STEP 5: Retrieval & occasional fixing

- Anglers reeled in lines and re-casted up to 15 to 20 times before fixing
- On occasion anglers need to fix their lines of any tangles and snags, this required a little room in order to balance or lay the rods



Organizing the Data

Finding a location:

- When trying to find a location, the docks are usually open spaces with no coverage from rain or other weather conditions such as hail
- Anglers had to find other means of protection (garbage bag)
- Dock fishing is limited to the areas that can be covered when casting

"It would be nice to have some shelter from the rain while fishing" – Carlos. M

Adding bait onto hooks:

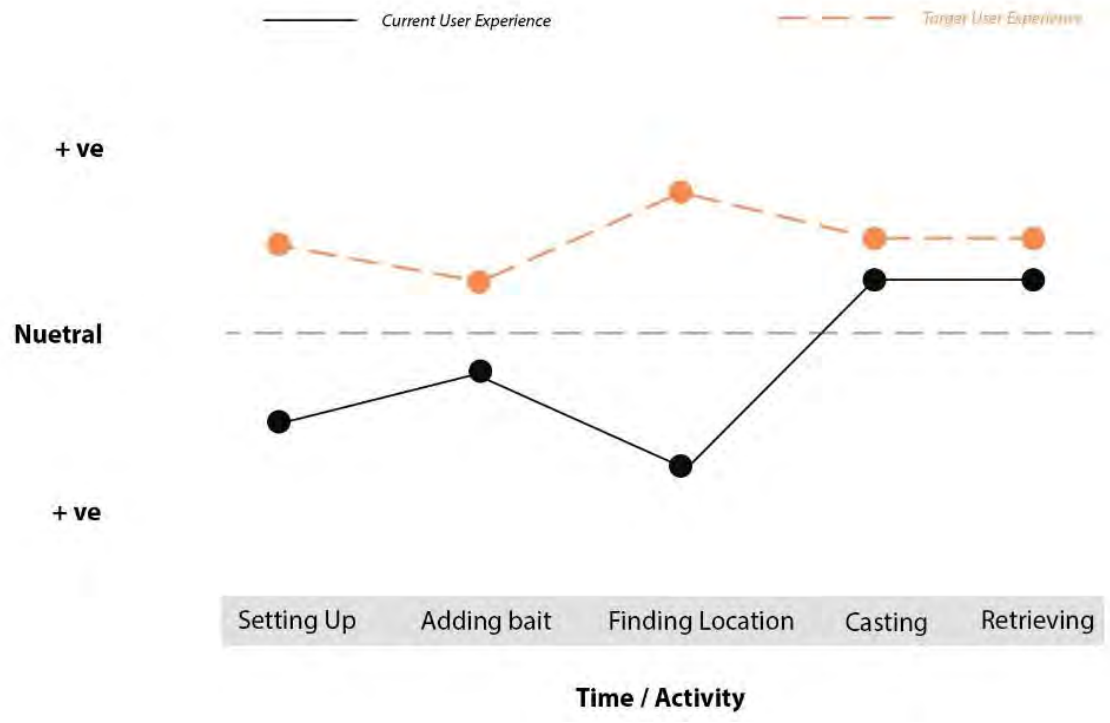
- Worms usually come in a standard white foam box which is light weight and flies away with wind
- Worms are usually not finished and get dumped into the water

"There should be worm posts readily available for anglers to eliminate the box" – Joseph. P

Additional concerns:

- Poor weather conditions such as hail, made it difficult for the anglers to use their boat
- The anglers has motorized problems due to weeds, resulting in damage and non usage

User Experience



Potential User Experience Improvement Chart

Key Activity	Steps	Current user experience	Potential improvement
Setting up the gear	Angler organizes gear and sets up tack on the rod	This task is frustrating depending on the amount of gear and space available. Rods are long and awkward enabling anglers to lay the rods on the floor	Opportunity to provide stands that allow anglers to set up and fix rods without using both hands and needing to lay the rod on the floor
Adding bait to the hooks	Live bait or lures are added to the hook	The current user experience for this task is easy, however, frustration occurs when worm boxes fly away due to wind	Providing stations with worms or worm "bins" on local fishing docks that can be re-used by other fishers or allow the worms to provide help to other systems
Finding a location	Searching for a location that has no casting interference	Finding a location is easy, however, there is an inconvenience of weather which challenges the fishing experience	Coverage from weather that allow angler to fish
Casting and waiting	Cast lines into water and wait for bites	Casting on the dock is easy and anglers are content	Roughly the same
Retrieval and fixing	Anglers retrieve lines and occasionally fix gear	Retrieving and fixing snags on the	Roughly the same

Overall Analysis

The observations from these categories are as followed. The preliminary video study showed that space in current benchmarked boats are limited for anglers of various sizes and ages. The limitations of movement restrict anglers from engaging in fishing activities while having to worry about their safety and the potential of falling overboard. Additional concerns included shelter from weather. In terms of dock fishing, weather conditions were a major factor that influenced the enjoyment of fishing. Nonetheless, live baits were not used up and dumped in the water. Overall, there is an opportunity to develop a product with a modular space, incorporated worm system and upgraded sheltering for a more relaxed fishing experience.

Appendix III - Product Research

Benchmarking I

1.1 Introduction

The objective of this report is to examine current benchmarked products that exist for recreational fishers and determine the main features and benefits in order to comprehend their importance and to note what could be applied. The products stated below were chosen in accordance to the needs of the primary and secondary user demographics which allow them to practice the sport.

1.2 List of Products

Eight comparable products

Ultraskiff 360

- Single user platform

https://www.ultraskiff.com/store/p24/Ultraskiff_360_with_Adjustable_Standard_Seat_Package_and_Minn_Kota_Endura_Max_55%2F42%22.html

Inflatable Fishing Float Tube

- Requires user to sit for a relaxed experience

https://classicaccessories.com/fish/inflatable-float-tubes/bighorn-float-tube

Intex Explorer 200 Inflatable Boat

- Inflatable floating unit for one user

https://www.canadiantire.ca/en/pdp/intex-explorer-200-inflatable-boat-0798312p.html

Colorado XT Pontoon Boat

- Includes anchor system and motor mounts
- Single user use

https://www.walmart.ca/en/ip/classic-accessories-colorado-xt-pontoon-boat/6000016944534?rrid=richrelevance

KingFisher Modular Fishing Kayak

- Single use unit can be taken apart
- Operated through paddle strokes

https://kayaks.point65.com/products/kingfisher-kayak

Aqua Marina Island Floating Plate

- Multiuser (2 people max)
- Can be combined using a buckle

https://www.aliexpress.com/item/32987168851.html

Topper 1542

- Multiuser boat with attachable motor capabilities

https://www.trackerboats.com/boat/?boat=4590

Fissot Kayak

- Single user kayak with stabilizer and paddle control

https://www.amazon.com/Fissot-1-Person-Folding-Fishing-Plastic/dp/B072N5L449

1.3 List of Features

- **single** or **multiple** users **seating**
- Craft or platforms should be **sturdy** for safety
- Craft or platforms should have **balance**
- Unit should be **comfortable** for the user
- Units should incorporate **storage** elements
- Portable or **modular**

1.4 Comparison of Features

Product	Cost (USD)	Material	Weight (lbs)	Sturdy	Storage	Balance	Seating
Ultraskiff 360	$1400 - $1900	UV resistant Polyethylene	Weight capacity 123 lbs	Very High	Yes	High	Single user
Inflatable Fishing Float Tube	$134.07	Polyvinyl Chloride	Item weight 12.34 lbs	Moderate	Yes	Moderate	Single user
Intex Explorer 200 Inflatable Boat	$18.96	Polyvinyl Chloride	Weight capacity 210 lbs	Low	No	Low	Single user
Colorodo XT Pontoon Boat	$854.57	Abrasion resistant PVC	Item weight 77 lbs	Moderate	No	High	Single user
King Fisher Modular Fishing Kayak	$3000 - $4000	Polyethylene	Item weight 70 lbs Weight capacity 287 lbs	Moderate	Yes	Moderate	Single user
Aqua Marina Island Floating Plate	$432.95	DWF material	Item weight 27.33 lbs Weight capacity 529 lbs	Low	No	Low	Multi-user
Topper 1542	$1399	Aluminum	Weight capacity 775 lbs	Moderate	No (open space)	Moderate	Multi-user
Fissot Kayak	$2997	N/A	Weight Capacity 110 lbs	High	Yes	High	Single user

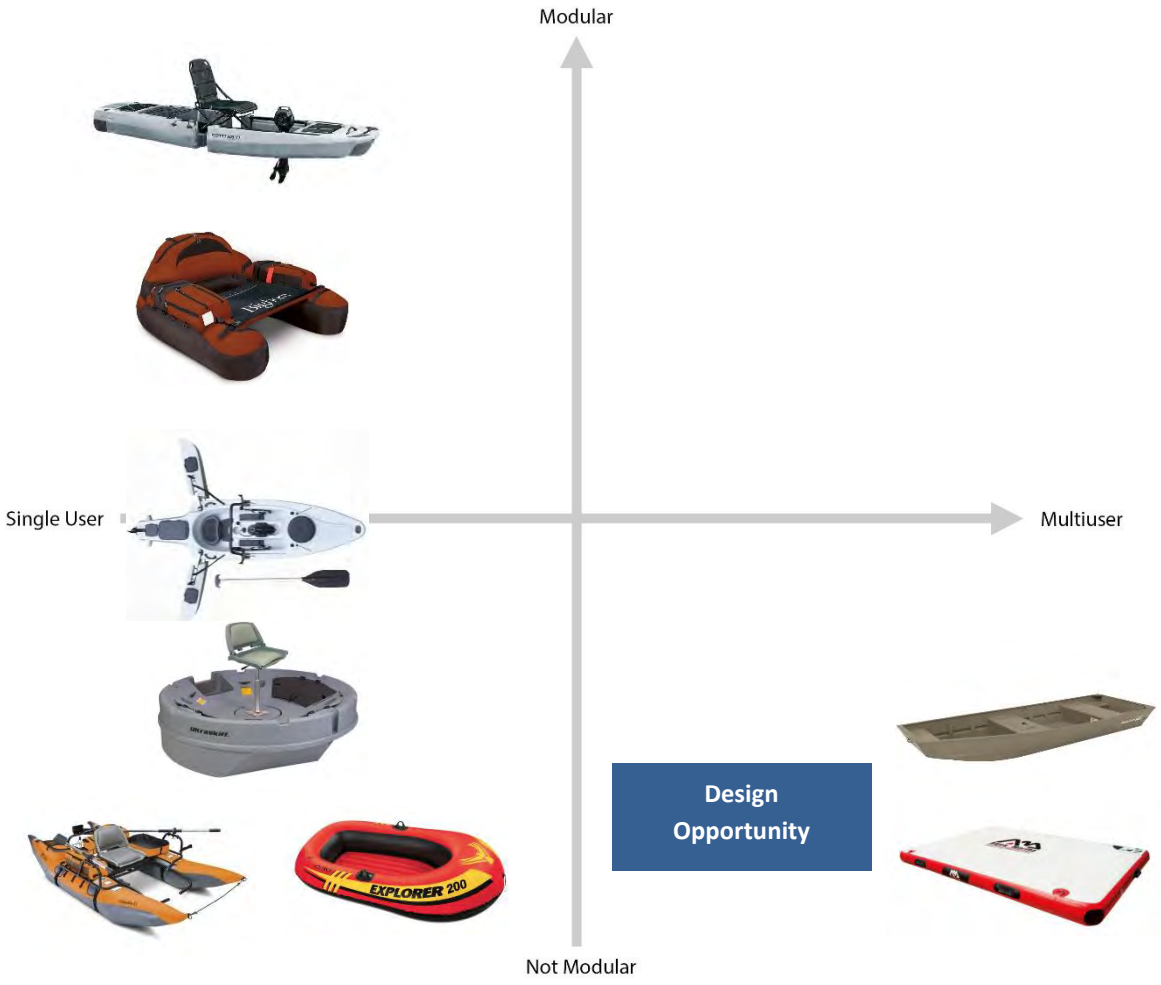
1.5 Conclusion

Overall, the table above provides detailed insight on the current solutions provided for recreational fishers. As shown, most available products in the market cater towards single user fishing experiences and storage units are equal in terms of their importance, splitting between a 50% availability in the case of this study. Weight capacities also play and importance and should be able to hold a user who is 200lbs and above.

Benchmarking II

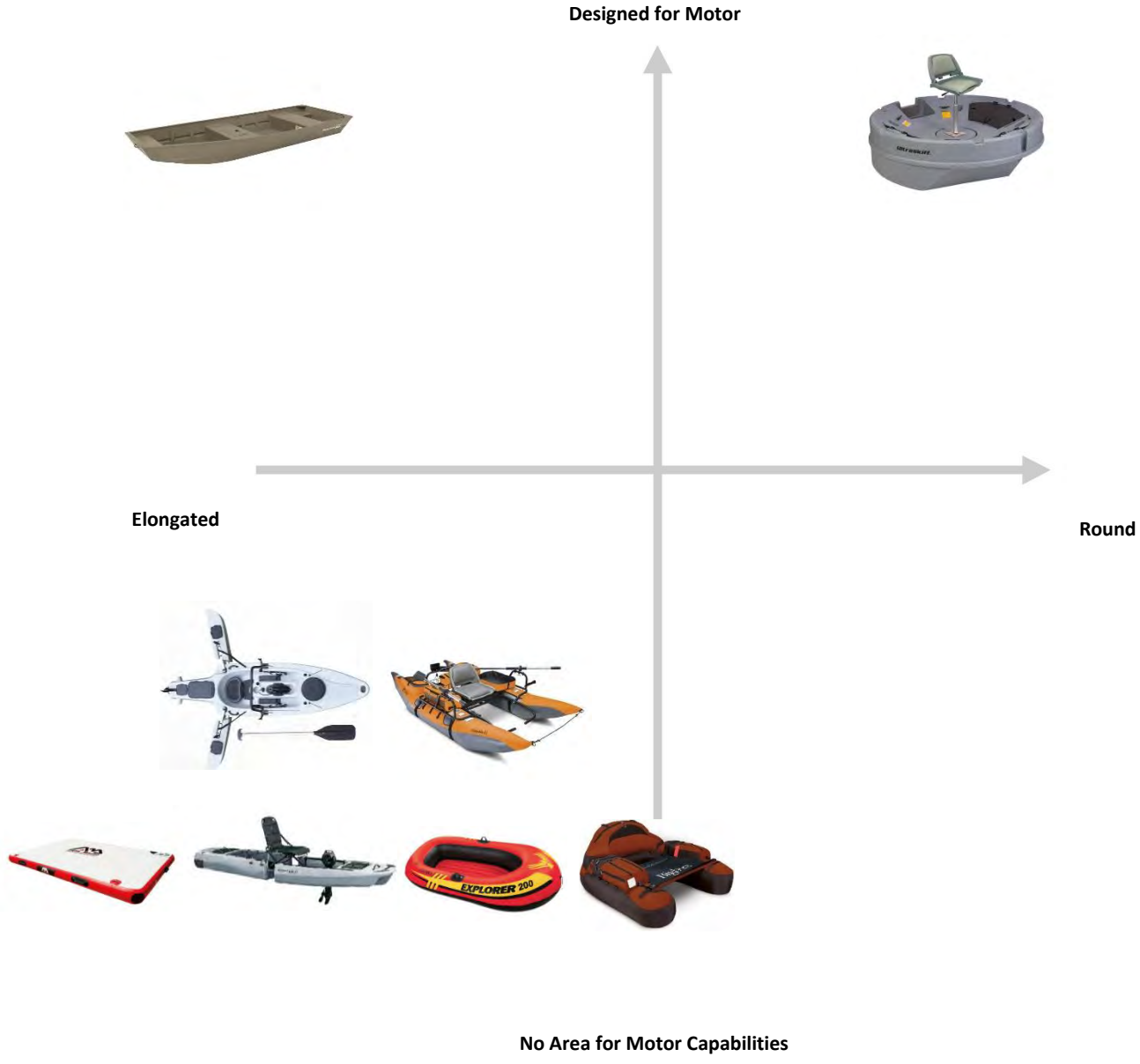
2.1 X-Y Graph 1

The following X-Y graph showcases the function of eight comparable products on a scatter plot in order to understand a potential design opportunity.



2.2 X-Y Graph 2

The following X-Y graph showcases the aesthetic of eight comparable products on a scatter plot in order to understand where a potential design opportunity.



2.3 Conclusion

A solution and design direction can be justified in conclusion to the above X-Y graphs in section 2.1 and 2.2. There is an indication in graph 2.1 that most benchmarked products are catered towards single user experiences and suggests that there is an opportunity to develop a solution that is perhaps modular or portable and incorporates a single or multi-user experience. Graph number 2 in section 2.2 shows a possible design opportunity for a product with a round shape that is designed with a section for motor capabilities since the benchmarked products presented are mainly elongated and require users to paddle manually.

Benchmarking III - Benefits & Features

3.1 Introduction

In order to understand the main targeted marketing information given for each product, benefits and features were analyzed through text analysis of advertisements and listings that the products were gathered from. The most commonly identified words are as such;

3.2 Key Benefits

Keyword	Frequency
Comfortable	3
Stable	3
Durable	4
Safety	3
Modular	3

3.3 Key Features

Keyword	Frequency
Storage	6
Handles	3
Rod Holders	4
Chair / seating	6
Motor	3

3.4 Benefit Comparison

Two products close to a design opportunity were chosen to compare based on how they met the needs of the customer as referenced in X-Y graph shown in section 2.1. The two products chosen for comparison were the Ulstraskiff 360 and the Auqa Marina Island Floating Plate. Both products are platforms which allow users to stand and fish with ample space.

3.5 Results

Benefits	Benefit comparison (good, excellent, poor)		
	Ultraskiff 360	**Aqua Marina Island Floating Plate**	**Possible Niche Market**
Comfortable	Good	Poor	X
Durable	Good	Good	
Stable	Excellent	Good	
Safety	Poor	Poor	X
Modular	Poor	Good	X

3.6 Conclusion

The results from the comparison chart in section 4.2 show that although the Ulstraskiff and Aqua Marina are similar products in terms of their purpose as a fishing platform, their modularity, comfort and stability differ. The commonality for both products include poor safety and good durability; this includes their materials being able to undergo harsh weather conditions and being able to hold a large weight capacity. These findings and information gathered from the possible niche markets, will help to inform the final design solution.

Benchmarking IV – Summary & Discussion

4.1 Discussion of conclusion 1.3

In section 1.3 from the eight comprible products gathered, the main features were distinguished according to the overall look and description of the benchmarked items. The features of the eight benchmarked products indicate that aspects such as durability, sturdiness and comfort are expremely important in the make of the design in order to provide a safe and relaxing experince for the end users, anglers and the general public. The benchmarked products also differ in accordance to single or multi-user experienced platforms, boats and kayaks which offer a variety of benefits and features catered for anglers.

4.2 Discussion of summary statements 2.3

The viewpoint for statement 2.3 was understood and concluded through an X-Y graphing technique which was able to showcase where each benchmarked product fit in terms of function and aesthetic. As stated in 2.3, the graphs show a potential design direction which includes providing a modular solution that caters to multiple or single users. Additionally, rounder shapes with motor space capabilites is not as apparent with the current benchmarked

products studied and showcases a possible niche market that could be further developed in order to enhance the recreational fishing experience.

4.3 Discussion of statements 3.2 and 3.3

In section three, charts 3.2 and 3.3 demonstarate the key benefits and features of the comparible products, understood through a text analysis of advertisments. The most frequent keyword used in the benefits section (3.2) is durable; this suggests that for fishing reated products including platforms, boats and kayaks, durability is highly considered and should continue to be enhanced for usage by anglers. Under the features section (3.3), storage and seating was the most frequent term used and can inform the potential design to include comfortable seating and sufficient storage for users.

Appendix IV – Needs Analysis

Benefits and Corresponding Fundamental Human Needs

The fundamental human needs corresponding to the product benefits for recreational fishing Research *was* determined and displayed in the Table below. The relative strength of relationship (strong/moderate/weak) was also indicated.

Table: Benefits and Corresponding Fundamental Human Needs

Recreational Fishing Transportation and comfort

	Benefit	**Possible Corresponding Fundamental Human Needs (FHN)**	**Relationship between Benefits and FHN**
1	Comfort	Control, security, self-esteem (mastery)	strong
2	Style	Esteem, belonging, aesthetically pleasing	moderate
3	Efficiency	Accomplishment, autonomy, self-esteem	strong
4	Ease	Accomplishment, autonomy, protection, security, control, self-esteem (mastery)	strong
5	Fun	Leisure (excitement), Participation, Belonging (shared fun)	strong

Comfort

In this context is increasing the sensory experience for the infant of being protected, connected with the caregiver and the outside environment, with some freedom to move safely)

Comfort also includes the harshness of the ride (ride harshness would contribute to a feeling of a *loss of control*, increasing possibility of injury (risk), both of which decrease one's sense of protection)

Security

is the major fundamental human need met.

Style

is an important expression of individuality. What is considered by the group as stylish, increases self-esteem.

Efficiency

is defined as the effort required to perform at a level. This is related to control the user has during the activity (autonomy)

Ease

is in many ways related to efficiency in terms for fundamental human needs (i.e. control, autonomy).

Fun

related to leisure ('travel' to new interesting environments) and belonging (shared fun, participation between infant and caregiver).

Statement of Need

To design a more flexible and comfortable product for fishing enthusiasts which takes into consideration new cultural changes that could enhance user experiences and mitigate stresses of traditional recreational fishing practices.

Appendix V – CAD Models

All CAD models including renderings, developmental processes and generated using SolidWorks, can be found in sections 4.7, 5.3

Appendix VI – Hard Model Photographs

For hard model photographs of the final thesis project, including mockups, please refer to sections 4.8 and 5.4

Appendix VII – Technical Drawings

All technical aspects of the final thesis project, including dimensional information, can be found in section 5.5.

Appendix VIII – Manufacturing Cost Report

Please refer to section 5.2.3 for the manufacturing cost report

IX – Sustainability Report

Abstract

The traditional methods of water transportation used for recreational fishing have long been targeted towards expert anglers, singling out the selection of available products for the general public and fishing enthusiasts who rely on rental units. For the general public, these units accompany both environmental and human centered difficulties that affect one's experience and overall enjoyment such as no protection from harsh weather conditions, uncomfortable seating and limited space which often leads to mild or fatal injuries. The premise of this report, outlines the sustainability aspects targeted towards the final design solution, including the materials, safety, technology and end of life considerations. This report will also evaluate the materials and manufacturing methods used in current benchmarked products in order to understand the purpose behind regularly used components, such as for stability, strength or weight ratios.

Literature Review

Sustainability within the standpoint of product design includes material considerations, financial considerations as well as environmental and social considerations. For products related to recreational fishing use, targeted towards watercrafts and boats, special consideration should be made with regards to the impact on freshwater species. Current methods and technologies that are popularized for recreational fishing units, incorporate gas powered engines and blades which are destructive to habitats through leaks, harmful chemicals and risks of injury for species. The following section will address these concerns, and work to understand the potential changes that can be made to the proposed design, in relation to the materials, costs and manufacturing methods that are used for current products. New technologies will also be explored in order to generate potential possibilities for future watercrafts.

Materials Used

The method to which materials are considered for the following benchmarked products and water crafts in general are heavily dependent on their ability to stay afloat above the water, provide balance and being able to withstand factors such as weather, snags on rocks, algae from weeds and any contact it may endure during it's time outdoors. Softer fabrics are also used primarily for higher-end products that give the users a luxurious and finished feel. The most used materials found include:

- UV resistant Polyethylene or HDPE
- Abrasion Resistant PVC
- DWF Material
- Aluminum
- Felt and carpet (inlayed for a complete finish)

Manufacturing Methods Used

The manufacturing methods used for the benchmarked products and generalized watercrafts are dependent on the material that is utilized, whether it be plastic or metal. The following manufacturing methods have been compiled from the current products and are a determining scope which allows to understand how the overall forms have been developed.

- Rotational molding
- Blow molding
- Metal cutting and bending (This procedure takes place for aluminum boats, the parts are cut from metal sheets and bent around a wooden template as well as reinforced with rivets)

Benchmarking – Sustainability

With regards to sustainability, there has been some but little consideration to the end life of water transportation products. Products such as kayaks which are rotational molded units made of HDPE, have been recycled in order to develop a resin-based material that allows for the remake of additional kayaks (Farrow, Johnson & Larson, 2000). Additional concepts such as bladeless motors, utilize systems equivalent to that of a Dyson fan and have been developed in order to help mitigate aquatic damage and danger to aquatic species, an example of this can be seen in the boat blade by Yanko design. Although small considerations have been thought through, much larger benchmarked products such as aluminum boats end up in the scrap yard where the parts either get recycled for usage of other items or simply end up in landfills. On average an item like that of a Kayak has an expectancy of 12 to 15 years, while a speedboat may have a lifespan of up to 30 years (Farrow, Johnson & Larson, 2000).

Safety

The current safety concern for the proposed fishing unit will continue to be the balance of the unit, with reaction to the water. The goal for the end unit is to provide space to eliminate users from stumbling into each other. The stylistic approach to the unit will also be designed in such a way that the balance of the unit will closely act in such a way, similar to the Ultraskiff 360 where the entirety of the unit is balanced out in accordance to movement and the water; this will reduce user fears of falling overboard the boat.

Health

The health for anglers is extremely vital when using recreational fishing products, especially for mobility and travel. Currently, there is little emphasis targeted towards the health of users when they are faced under weather conditions such as rain or hail. The health of users can better be accommodated through covers. The health of anglers is also accommodated through safety aspects such as the use of lifejackets which is external from the design of the fishing unit.

Environment

The construction of the fishing unit is dependent on the material used for the product such as plastic due to its lightweight characteristics and resistance to rust. The overall material will complement the conditions that the unit is faced in. Environment will also be considered through the motors used to make the unit mobile such as utilizing new advancements in technology such as the fish friendly, bladeless motors, conceptualized by Yanko Designs.

Product End of Life

As mentioned in section 2.2.5, the end of life for current benchmarked products is considered depending on the material used for the unit, whether it be aluminum or plastic. In terms of the finalized solution, there is a chance to develop the unit using recyclable plastics or newly, scientifically investigated materials that are upcoming. The research for materials which will determine the end of life is still under consideration, however, will adapt to the challenged use of the product and environment.

Sustainability

Floatex incorporates aspects of sustainability within its design through its choice of materials and development in mechanisms, allowing for the utilization of autonomous technology. Further discussed below, are the materials and power sources used by Floatex.

High-Density Polyethylene

High-Density Polythene is a durable plastic made from petroleum (HDPE, 2018). The material is resistant to rust and suitable for outdoor weather conditions including rain or snow, making it viable for the exterior elements of Floatex, including it's base, molded seating elements, storage and additionally its internal structure (HDPE, 2018). In terms of sustainability, HDPE is considered environmentally friendly, since the end life of the material can be recycled and manipulated into composite wood or plastic lumber (HDPE, 2018). The manufacturing capabilities of High-Density Polyethylene include blow molding which will allow to create the exterior shape of Floatex (HDPE, 2018).

Cordura Eco-Fabric (Nylon)

Cordura Fabric is an eco-friendly material made from recycled polyester yarns (Cordura, n.d.). The fabric is resistant to tears and is suitable for outdoor weather conditions

due to its water repellant capabilities (Cordura, n.d.). The fabric will be utilized for the seating shade that is housed on Floatex in order to protect anglers from weather conditions including rain or give shade to users during humid weather conditions (Cordura, n.d.).

Technology – Autonomous Capabilities

With the advancement in technology working to be developed for watercrafts, Floatex incorporates autonomous capabilities with the use of robotic GPS modules, micro-controllers and sensors which allow each individual unit to connect to one another without the use of human assistance (Matheson, 2019). The sensors and mechanisms housed in the electrical unit of the platforms body, allows for the unit to navigate its connector into the latching mechanism, connecting units together to form large floating docks which can be further attached to or detached if a single unit is needed (Matheson, 2019). This technology was first introduced by MIT researchers and has the capability to be utilized with Floatex in order to generate opportunities for modern fishing practices (Matheson, 2019). The combination of these technologies, allow for an ecofriendly unit due to the electrical powering system that will be integrated within the unit, eliminating the use of gas and potential for oil leaks in the water.

X - Topic Approval Form

Humber Institute of Technology & Advanced Learning
School of Applied Technology
Bachelor of Applied Technology – Industrial Design
Winter 2020
iDSN 4502 Senior Level Thesis Project II
Dennis L. Kappen/Catherine Chong/Sandro Zaccolo

THESIS DESIGN APPROVAL FORM

NAME

April Seenumar

Floatec~~ss~~ ?

TOPIC TITLE (Brand)

Modular Recreational Fishing Platform

PS: Ensure that the visualization of the final design, side views and front views in Illustrator or Photoshop are required to be shown to us for securing an approval

Thesis design is approved to proceed for the following: Week #4 Jan 28

a **CAD Design Phase** — 1:13 scale with detailing.

a **Rapid Prototyping and model building phase**

↳ pending for review of CAD.

COMMENTS:

Week #5 Feb 4 → initial CAD development.
→ suggested to refine the opening for seat/walkway (P.T.O) →
→ need to review detailing/finishing next week.

Week #6 Feb 11 → CAD refined good progress.
→ a few more revise in detailing
→ to review complete CAD next week.

Signed a

Catherine Chong / Dennis L. Kappen

Week #7 Feb 18 → CAD refined, good progress, need to include non-slip areas
→ ready to model / laser cut.

Week #9 Mar 10 → CAD completed, started 3D print. → to email finishing to review by Friday 12pm.
→ Report progress well, banner still need draft.

Humber Institute of Technology & Advanced Learning
Bachelor of Applied Technology – Industrial Design
IDSN 4002 Senior Level Thesis 1
Catherine Chong, Dennis Kappen, Sandro Zaccolo

School of Applied Technology
Fall 2019

THESIS TOPIC APPROVAL

STUDENT NAME:

April Seekumar

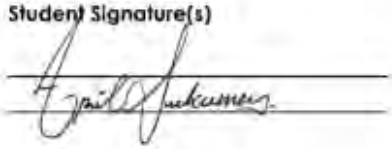
TOPIC TITLE

How may we improve the recreational fishing experience?

Abstract

The practice of recreational fishing accompanies both environmental and human centered difficulties that are faced with traditional methods of water transportation. The utilization of boats or fishing platforms allow anglers to cover vast areas of water, however, these methods limit space, comfort and stability for experienced anglers and general fishing enthusiasts, often leading to injury or death from falling in or overboard the craft. Environmentally, the leakage of fuels and chemicals such as lead, are emitted into waterways, killing fish stocks and damaging the environmental conditions for aquatic species. The goal of this thesis proposal is to challenge the notion of existing transportation units, through an in-depth ergonomic study and analysis of current watercraft requirements, in order to enhance the recreational fishing experience and help to mitigate aquatic damage. User research including interviews and observational studies will give detail and justify the design evolution in order to eliminate the current challenges faced by anglers. Additionally, with reference to existing platforms and boats, a one to one scaled model will be developed in order to understand ergonomics and human scale as well as to evaluate feasibility. Results from this analysis will attain a design solution that helps to lessen injuries for recreational fishers and improve aquatic ecosystems.

Student Signature(s)

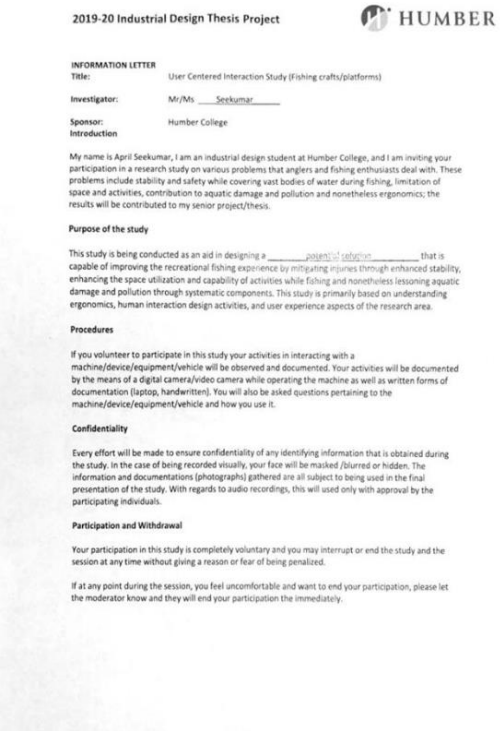


Date October 1st, 2019

Instructor Signatures

Date October 1st, 2019

XI - Advisor Meetings & Agreement Forms



2019-20 Industrial Design Thesis Project

HUMBER

INFORMATION LETTER

Title: User Centered Interaction Study (Fishing crafts/platforms)

Investigator: Mr/Ms Seekumar

Sponsor: Humber College

Introduction

My name is April Seekumar, I am an industrial design student at Humber College, and I am inviting your participation in a research study on various problems that anglers and fishing enthusiasts deal with. These problems include stability and safety while covering vast bodies of water during fishing, limitation of space and activities, contribution to aquatic damage and pollution and nonetheless ergonomics; the results will be contributed to my senior project/thesis.

Purpose of the study

This study is being conducted as an aid in designing a potential solution that is capable of improving the recreational fishing experience by mitigating injuries through enhanced stability, enhancing the space utilization and capability of activities while fishing and nonetheless lessoning aquatic damage and pollution through systematic components. This study is primarily based on understanding ergonomics, human interaction design activities, and user experience aspects of the research area.

Procedures

If you volunteer to participate in this study your activities in interacting with a machine/device/equipment/vehicle will be observed and documented. Your activities will be documented by the means of a digital camera/video camera while operating the machine as well as written forms of documentation (laptop, handwritten). You will also be asked questions pertaining to the machine/device/equipment/vehicle and how you use it.

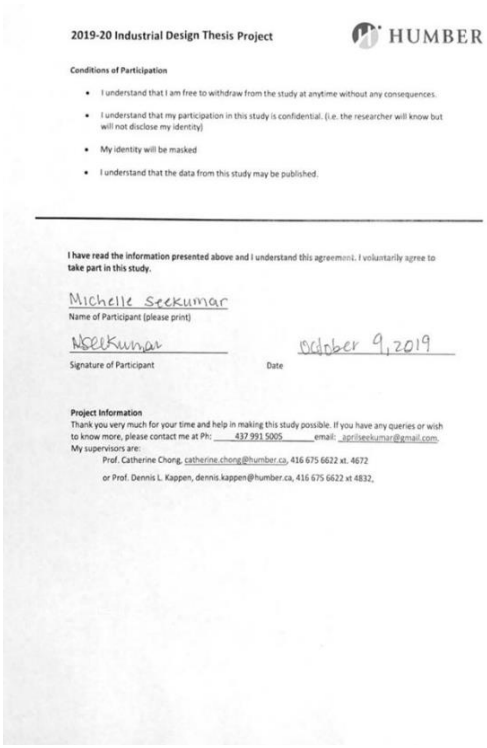
Confidentiality

Every effort will be made to ensure confidentiality of any identifying information that is obtained during the study. In the case of being recorded visually, your face will be masked /blurred or hidden. The information and documentations (photographs) gathered are all subject to being used in the final presentation of the study. With regards to audio recordings, this will used only with approval by the participating individuals.

Participation and Withdrawal

Your participation in this study is completely voluntary and you may interrupt or end the study and the session at any time without giving a reason or fear of being penalized.

If at any point during the session, you feel uncomfortable and want to end your participation, please let the moderator know and they will end your participation the immediately.



2019-20 Industrial Design Thesis Project

HUMBER

Conditions of Participation

- I understand that I am free to withdraw from the study at anytime without any consequences.
- I understand that my participation in this study is confidential. (i.e. the researcher will know but will not disclose my identity)
- My identity will be masked
- I understand that the data from this study may be published.

I have read the information presented above and I understand this agreement. I volunteer to take part in this study.

Michelle Seekumar
Name of Participant (please print)

MSeekumar — October 9, 2019
Signature of Participant — Date

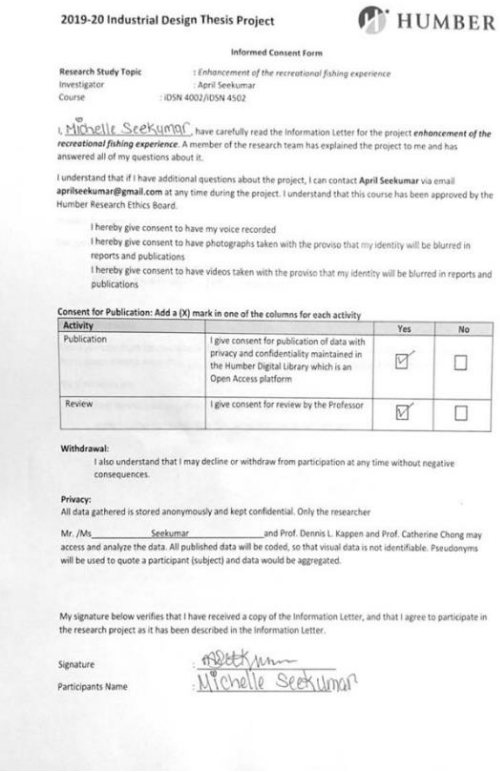
Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more, please contact me at Ph: 437 991 5005 email: aprilseekumar@gmail.com.

My supervisors are:

Prof. Catherine Chong, catherine.chong@humber.ca, 416 675 6622 xt. 4672

or Prof. Dennis L. Kappen, dennis.kappen@humber.ca, 416 675 6622 xt 4832.



2019-20 Industrial Design Thesis Project

HUMBER

Informed Consent Form

Research Study Topic : *Enhancement of the recreational fishing experience*
Investigator : April Seekumar
Course : IDSN 4002/IDSN 4502

I, Michelle Seekumar, have carefully read the Information Letter for the project ***enhancement of the recreational fishing experience***. A member of the research team has explained the project to me and has answered all of my questions about it.

I understand that if I have additional questions about the project, I can contact **April Seekumar** via email **aprilseekumar@gmail.com** at any time during the project. I understand that this course has been approved by the Humber Research Ethics Board.

I hereby give consent to have my voice recorded
I hereby give consent to have photographs taken with the proviso that my identity will be blurred in reports and publications
I hereby give consent to have videos taken with the proviso that my identity will be blurred in reports and publications

Consent for Publication: Add a (X) mark in one of the columns for each activity

Activity		Yes	No
Publication	I give consent for publication of data with privacy and confidentiality maintained in the Humber Digital Library which is an Open Access platform	☑	☐
Review	I give consent for review by the Professor	☑	☐

Withdrawal:

I also understand that I may decline or withdraw from participation at any time without negative consequences.

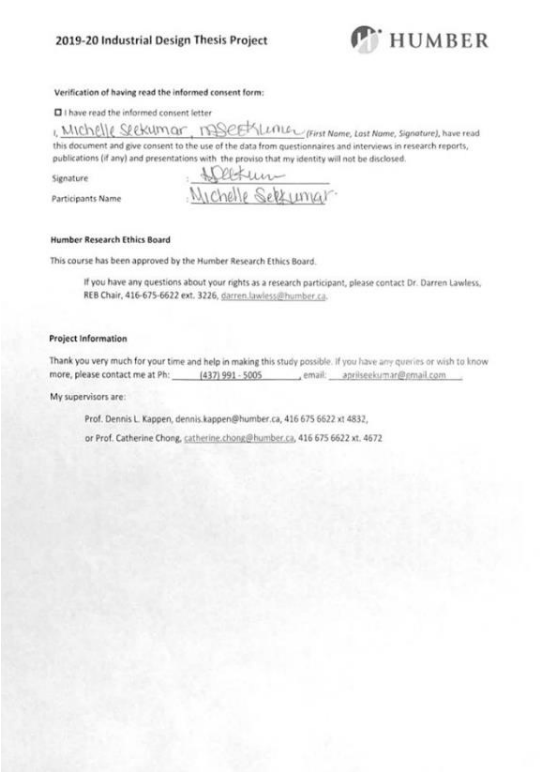
Privacy:

All data gathered is stored anonymously and kept confidential. Only the researcher

Mr. /Ms Seekumar and Prof. Dennis L. Kappen and Prof. Catherine Chong may access and analyze the data. All published data will be coded, so that visual data is not identifiable. Pseudonyms will be used to quote a participant (subject) and data would be aggregated.

My signature below verifies that I have received a copy of the Information Letter, and that I agree to participate in the research project as it has been described in the Information Letter.

Signature : MSeekumar
Participants Name : Michelle Seekumar



2019-20 Industrial Design Thesis Project

HUMBER

Verification of having read the informed consent form:

☐ I have read the informed consent letter

I, Michelle Seekumar, MSeekumar *(First Name, Last Name, Signature)*, have read this document and give consent to the use of the data from questionnaires and interviews in research reports, publications (if any) and presentations with the proviso that my identity will not be disclosed.

Signature : MSeekumar
Participants Name : Michelle Seekumar

Humber Research Ethics Board

This course has been approved by the Humber Research Ethics Board.

If you have any questions about your rights as a research participant, please contact Dr. Darren Lawless, REB Chair, 416-675-6622 ext. 3226, darren.lawless@humber.ca.

Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more, please contact me at Ph: (437) 991 - 5005, email: aprilseekumar@gmail.com

My supervisors are:

Prof. Dennis L. Kappen, dennis.kappen@humber.ca, 416 675 6622 xt 4832,

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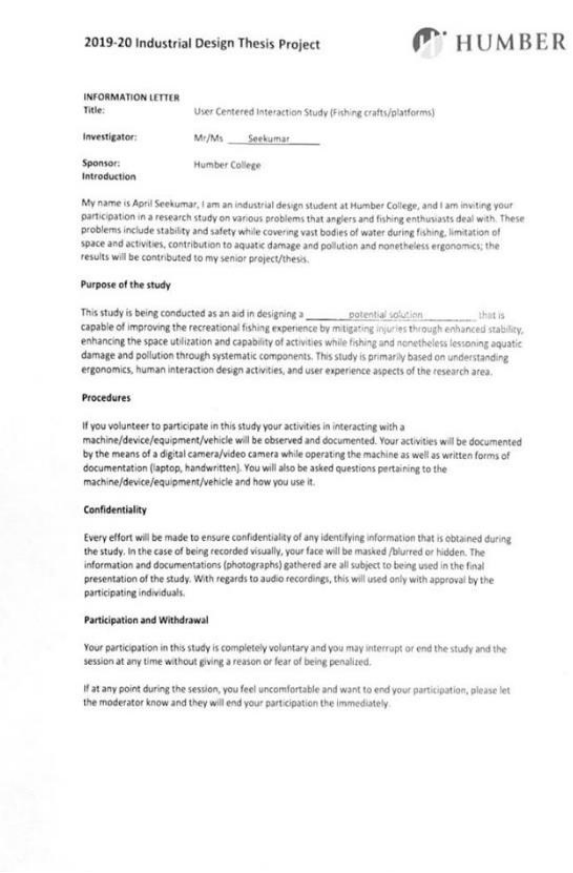

2019-20 Industrial Design Thesis Project

HUMBER

INFORMATION LETTER

Title: User Centered Interaction Study (Fishing crafts/platforms)

Investigator: Mr/Ms Seekumar

Sponsor: Humber College

Introduction

My name is April Seekumar, I am an industrial design student at Humber College, and I am inviting your participation in a research study on various problems that anglers and fishing enthusiasts deal with. These problems include stability and safety while covering vast bodies of water during fishing, limitation of space and activities, contribution to aquatic damage and pollution and nonetheless ergonomics; the results will be contributed to my senior project/thesis.

Purpose of the study

This study is being conducted as an aid in designing a potential solution that is capable of improving the recreational fishing experience by mitigating injuries through enhanced stability, enhancing the space utilization and capability of activities while fishing and nonetheless lessoning aquatic damage and pollution through systematic components. This study is primarily based on understanding ergonomics, human interaction design activities, and user experience aspects of the research area.

Procedures

If you volunteer to participate in this study your activities in interacting with a machine/device/equipment/vehicle will be observed and documented. Your activities will be documented by the means of a digital camera/video camera while operating the machine as well as written forms of documentation (laptop, handwritten). You will also be asked questions pertaining to the machine/device/equipment/vehicle and how you use it.

Confidentiality

Every effort will be made to ensure confidentiality of any identifying information that is obtained during the study. In the case of being recorded visually, your face will be masked /blurred or hidden. The information and documentations (photographs) gathered are all subject to being used in the final presentation of the study. With regards to audio recordings, this will used only with approval by the participating individuals.

Participation and Withdrawal

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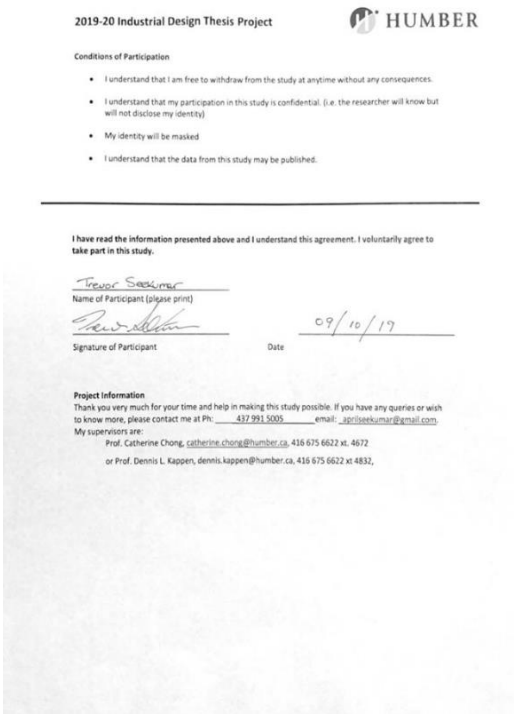


2019-20 Industrial Design Thesis Project

HUMBER

Conditions of Participation

- I understand that I am free to withdraw from the study at anytime without any consequences.
- I understand that my participation in this study is confidential. (i.e. the researcher will know but will not disclose my identity)
- My identity will be masked
- I understand that the data from this study may be published.

I have read the information presented above and I understand this agreement. I voluntarily agree to take part in this study.

Trevor Seekumar
Name of Participant (please print)

Signature of Participant

09/10/19
Date

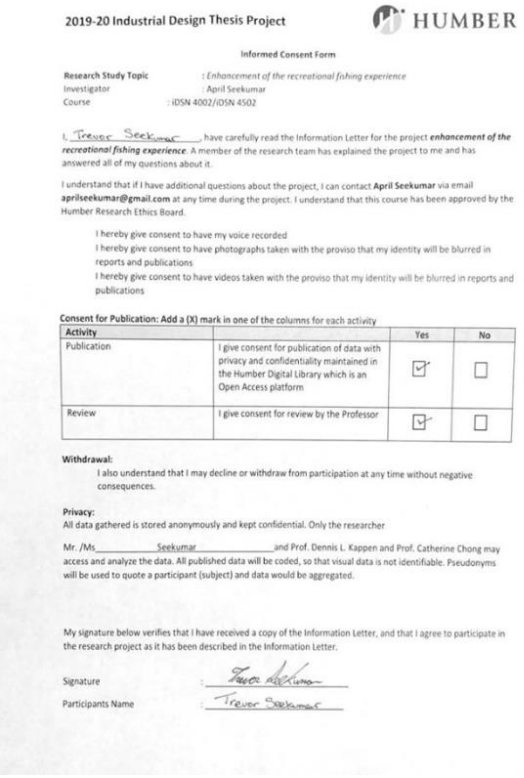
Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more, please contact me at Ph: 437 991 5005 email: aprilseekumar@gmail.com.

My supervisors are:

Prof. Catherine Chong, catherine.chong@humber.ca, 416 675 6622 xt. 4672

or Prof. Dennis L. Kappen, dennis.kappen@humber.ca, 416 675 6622 xt 4832,



2019-20 Industrial Design Thesis Project

HUMBER

Informed Consent Form

Research Study Topic : *Enhancement of the recreational fishing experience*
Investigator : April Seekumar
Course : iDSN 4002/iDSN 4502

I, Trevor Seekumar, have carefully read the Information Letter for the project ***enhancement of the recreational fishing experience***. A member of the research team has explained the project to me and has answered all of my questions about it.

I understand that if I have additional questions about the project, I can contact **April Seekumar** via email **aprilseekumar@gmail.com** at any time during the project. I understand that this course has been approved by the Humber Research Ethics Board.

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Withdrawal:

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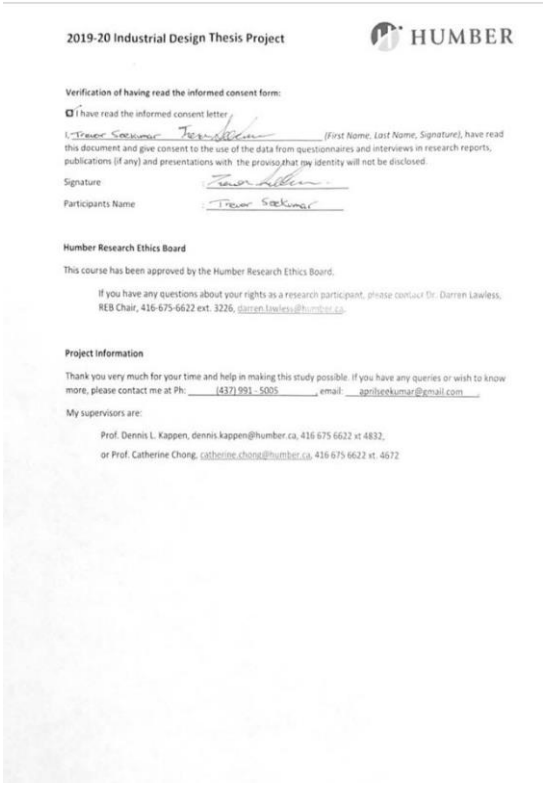
My signature below verifies that I have received a copy of the Information Letter, and that I agree to participate in the research project as it has been described in the Information Letter.

Signature :

Participants Name : Trevor Seekumar



2019-20 Industrial Design Thesis Project

HUMBER

Verification of having read the informed consent form:

☑ I have read the informed consent letter

I Trevor Seekumar *(First Name, Last Name, Signature)*, have read this document and give consent to the use of the data from questionnaires and interviews in research reports, publications (if any) and presentations with the proviso that my identity will not be disclosed.

Signature :

Participants Name : Trevor Seekumar

Humber Research Ethics Board

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Project Information

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Prof. Dennis L. Kappen, dennis.kappen@humber.ca, 416 675 6622 xt 4832,

or Prof. Catherine Chong, catherine.chong@humber.ca, 416 675 6622 xt. 4672

2019-20 Industrial Design Thesis Project HUMBER

INFORMATION LETTER

Title: User Centered Interaction Study (Fishing crafts/platforms)

Investigator: Mr/Ms Seekumar

Sponsor: Humber College

Introduction

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2019-20 Industrial Design Thesis Project HUMBER

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- My identity will be masked
- I understand that the data from this study may be published.

I have read the information presented above and I understand this agreement. I voluntarily agree to take part in this study.

Malcolm Cullen

Name of Participant (please print)

Signature of Participant Date 9th Oct. 2019.

Project Information

Thank you very much for your time and help in making this study possible. If you have any queries or wish to know more, please contact me at Ph: 437 991 5005 email: aprilseekumar@gmail.com.

My supervisors are:

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2019-20 Industrial Design Thesis Project HUMBER

Informed Consent Form

Research Study Topic : *Enhancement of the recreational fishing experience*
Investigator : April Seekumar
Course : IDSN 4002/IDSN 4502

I, Malcolm Cullen, have carefully read the Information Letter for the project ***enhancement of the recreational fishing experience***. A member of the research team has explained the project to me and has answered all of my questions about it.

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My signature below verifies that I have received a copy of the Information Letter, and that I agree to participate in the research project as it has been described in the Information Letter.

Signature :

Participants Name : Malcolm Cullen

2019-20 Industrial Design Thesis Project HUMBER

Verification of having read the informed consent form:

☐ I have read the informed consent letter

I, Malcolm Cullen (*First Name, Last Name, Signature*), have read this document and give consent to the use of the data from questionnaires and interviews in research reports, publications (if any) and presentations with the proviso that my identity will not be disclosed.

Signature :

Participants Name : Malcolm Cullen

Humber Research Ethics Board

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or Prof. Catherine Chong, catherine.chong@humber.ca, 416 675 6622 xt. 4672

XII – Other Supportive Raw Data

No other supportive raw data is included in this section

XIII – Topic Specific Data, Papers, Publications

PANEL ON RESEARCH ETHICS
Navigating the ethics of human research

TCPS 2: CORE

Certificate of Completion

This document certifies that

April Seekumar

has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)

Date of Issue: **3 September, 2019**