

FLOATING DEBRIS TRAP SYSTEM

BACKGROUND

[0001] Waterborne pollutants, such as floating debris and trash, can collect in large bodies of water or along shorelines and beaches. The pollutants create environmental concerns, being a threat to wildlife and health. In addition, the pollutants can degrade the aesthetics of the environment, which can negatively affect the economy, such as decrease in tourism or property value. Therefore, removing floating debris can be time consuming, tedious and costly. Floating debris collection systems have been proposed to ease the effort of collecting the debris.

[0002] However, such systems have been ineffective. For example, conventional systems do not into take account of changing water levels. The changing water levels can create stress in conventional systems. Such stress can cause defects or breakage, rendering the systems ineffective.

[0003] From the foregoing discussion, it is desirable to improve collection of floating debris.

SUMMARY

[0004] A debris collection system is presented. The debris collection system includes a trap and first and second floating guides. The first ends of the floating guides are coupled to corners of the trap for keeping the trap on a surface of a waterway. A release mount is coupled to a second end of the second guide. The release mount enables release of the system, allowing navigation through the waterway while collecting debris.

[0005] These and other objects, along with advantages and features of the present invention herein disclosed, will become apparent through reference to the following description and the accompanying drawings. Furthermore, it is to be understood that the features of the various embodiments described herein are not mutually exclusive and can exist in various combinations and permutations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] In the drawings, like reference characters generally refer to the same parts throughout the different views. Also, the drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the following description, various embodiments of the present invention are described with reference to the following drawings, in which:

[0007] Fig. 1a shows a top view of an embodiment of a floating debris collection system;

[0008] Fig. 1b shows a frontal view of a subsystem of a floating debris collection system;

[0009] Fig. 1c shows a frontal view of another subsystem of a floating debris collection system;

[0010] Figs. 2a-b show side and top views of an embodiment of a floating mount of a floating debris collection system;

[0011] Figs. 3a-b shows side and front views of a release mount of a floating debris collection system;

[0012] Fig. 4 shows a fixed mount of a floating debris collection system;

[0013] Fig. 5a shows boom linker and flexible joint of a floating debris collection system;

[0014] Figs. 5b-c show another flexible joint and boom linker of a floating debris collection system; and

[0015] Figs. 6a-b show front and side views of a debris trap.

DETAILED DESCRIPTION

[0016] Embodiments generally relate to collecting floating debris. In particular, embodiments relate to a debris collection system including a floating debris trap. Fig. 1a shows a top view of an embodiment of a floating debris collection system 110. Figs. 1b-c shows frontal views of different embodiments of one of the sub-systems of the debris collection system.

[0017] Referring to the Figs. 1-c, the system, for example, is installed in a waterway 101 having a flow direction 102, such as a river or a canal. The system can also be installed in other

types of waterways or bodies of water, for example, the system can also be installed in a body of water or a portion thereof to collect floating debris. In one embodiment, the collection system comprises first and second subsystems 120a and 120b. Providing a collection system with other number of subsystems, including 1, is also useful. A subsystem is coupled to first and second sides or banks 109a-b of the waterway. It is understood that the first and second sides can also be part of a shore of a body of water. For example, it is not necessary that the banks be distinct banks, but instead can be a contiguous bank.

[0018] A subsystem includes a floating debris trap 140. Front and side views of an embodiment of a floating debris trap are shown in Figs. 6a-b. Referring to Figs. 6a-b, the floating debris trap 140, for example, comprises a debris collector 601. The debris collector comprises a collection frame 602. The collection frame, for example, forms a rectangular box having a front side 142, a back side 144 and opposing sides 145a-b. Providing a collection frame having other geometric shapes may also be useful. The frame supports a mesh. The mesh allows water to pass through but not the floating debris. In one embodiment, the mesh and frame may be formed from steel. Other types of materials for forming the frame and mesh are also useful.

[0019] The collection frame is mounted onto floats 603. In one embodiment, first and second floats are located on opposing sides of the collection frame. The floats, for example, comprise floating booms. Other types of floats or float configurations can also be useful. When disposed in water, the floats keep the collector on a surface 103 of the water. A bottom of the collector is located below water with a top located above the water.

[0020] The back side of the collector is provided with a gate 620. When the gate is closed, the debris floating into the collector is trapped therein. Opening the gate allows debris to be emptied from the collector. In one embodiment, the gate comprises a drop gate having a rectangular frame supporting a wire mesh. The gate slides up and down along gate channels 622. Other types of gates are also useful.

[0021] The front side of the collector, in one embodiment, is provided with a unidirectional flow controller 630. The unidirectional flow controller allows debris to flow into the collector but not back out. In one embodiment, the unidirectional flow controller comprises a rubber flap or flaps. The rubber flap, for example, hangs from the top of the collector frame. Other types of unidirectional flow controller may also be useful. Railings 650 may be provided on the top surface of the collector. In one embodiment, skirts 660 can be provided at the bottom of the collector. The skirts, for example, comprise nylon skirts. Other types of skirts can also be useful.

[0022] In other embodiments, other types of floating debris traps may also be used. For example, floating debris traps manufactured by Bandalong International of Australia may be used.

[0023] Referring back to Figs. 1a-c, the first subsystem, as indicated by dotted lines, further includes a first floating guide 152 and a second floating guide 153 coupled to the debris trap. The debris trap, as shown, comprises a rectangular shape having a front side 142, a back side 144 and opposing side surfaces 146a-b. Other geometric shapes may also be useful. In one embodiment, the front and back side is aligned about perpendicular to the banksflow while the opposing side surfaces are aligned about parallel to the banks. The front side, for example, serves as the trap opening and the back side serves as the trap release side.

[0024] In one embodiment, the floating guides comprise booms. Other types of floating guides are also useful. The booms float on the surface of the water. In one embodiment, the booms comprise polyethylene pipes. Forming booms from other types of materials are also useful. First ends 154a and 155a of the floating guides are coupled to the opposing side surfaces of the trap. In one embodiment, the first ends of the floating guides are coupled to the trap at about the interface of the front side and opposing side surfaces.

[0025] Second ends 154b and 155b of the floating guides are coupled to first and second mounts 170 and 180 disposed on, for example, first and second sides 109a-b of the waterway. The trap and floating guides of the sub-system float above the water line 103.

[0026] To prevent debris from possibly floating beneath the floating guides, a net 156 may be provided. The net hangs from the floating guide. In one embodiment, the net extend a depth of about 1 meter below the surface of the water. Providing a net which extends to other depths may also be useful. Additionally, a net may also be provided form the trap. With respect to the net for the trap, it may be angled to facilitate moving the debris upward through the trap opening.

[0027] When the trap and floating guides are mounted to the sides, they form a V-shape. The V-shape of the sub-system facilitates debris collection by the trap. For example, debris flowing downstream contacts one of the floating guides and is directs is into the trap through the trap opening.

[0028] In one embodiment, the trap of the first sub-system is disposed closer to the first side of the waterway than the second side. For example, the trap is disposed about 15 – 40% of the total width of the waterway as measured from the closer side. In another embodiment, the trap is disposed about 20 – 35% of the total width of the waterway as measured from the closer side. The trap should be disposed less than 50% of the total width of the waterway as measured from the closer side. Disposing the trap at other distances may also be useful.

[0029] As for the second end of the second floating guide, it terminates at about 60 – 85% of the total width of the waterway, as measured from side of the waterway which is closer to the trap. In other embodiments, the second end of the second floating guide terminates at about 60 – 80% of the total width of the waterway, as measured from side of the waterway which is closer to the trap. The termination of the second end of the second floating guide is greater than 50% of the total width of the waterway as measured from the side of the waterway which the trap is closer. Terminating the second end of the second floating guide at other distances may also be useful. The portion of the subsystem from the second end of the second floating guide to the and second side of the waterway forms a pass region 168.

[0030] Although the first and second floating guides are depicted as single units, it is understood that this is only for illustration purposes. A floating guide unit can be about 3000 –

6000 mm. Other lengths of the floating boom are also useful. The floating guides can be formed from multiple units linked together to achieve the desired length. For example, as shown in Figs. 1b-c, the second floating guide can be formed from first and second units 153a-b which are linked together. Other configurations of floating guides may also be useful.

[0031] In one embodiment, one of the first and second mounts comprises a quick release mount and the other mount comprises a floating mount. In one embodiment, the second mount to which the second end of the second floating guide is coupled is a quick release mount. The quick release mount enables the sub-system to be quickly and easily decoupled from the second side of the waterway, leaving it tethered to the first side of the waterway via the second end of the first floating guide. The second end of the second floating guide can be coupled to the second mount by a cable 163. The second mount, for example, is mounted to the side of the waterway such that at least a portion is disposed below the water surface in the pass region. Disposing the cable below the surface of the water provides a pass region through which a boat may pass.

[0032] In one embodiment, the second end of the first floating guide is coupled to the floating mount. The floating mount can be slidably adjustable according to changes in water level. This is particularly useful since the first floating guide is mounted close to the first mount. The change in water level maintains the first floating guide on the surface of water.

[0033] As shown in Fig. 1b, the mounts are attached to vertical or substantially vertical sides of the waterway (e.g., perpendicular or substantially perpendicular to the water surface). For waterways with graded or slanted sides, a bracket mount, as shown in Fig. 1c, can be used. The bracket mount is configured to enable the mounts to be vertical or substantially vertical. A mesh may be provided for the bracket mount to prevent passage of debris. In one embodiment, the bracket mount is attached to the sides at an angle to facilitate directing the debris into the trap.

[0034] The second subsystem is disposed, for example, downstream from the first subsystem. The second subsystem is similar to the first subsystem except that the trap is located

closer to the second side than the first side. In one embodiment, the second floating guide of second subsystem overlaps the second floating guide of the first subsystem. Such a configuration of subsystems ensure that debris are trapped either by the trap of the first or second subsystem. For example, debris which passes through the first subsystem through the pass region is collected by the trap of the second subsystem. No debris should pass through the pass region of the second subsystem since it would have contacted the first floating guide and collected by the trap of the first subsystem. Furthermore, a boat may navigate through the system along a path (dotted line) which passes through the pass regions of the subsystems.

[0035] To further stabilize the trap, a back corner of the trap on the opposing side closer to the bank of the waterway is coupled to that bank. For example, the back corner of the trap of the first subsystem is coupled to the second mount of the second subsystem. A separate mount may be provided for the back corner of the trap in the second subsystem.

[0036] The components of the system or subsystem, such as floating guides and traps are interconnected by flexible coupling units 185. A coupling unit couples a first component to a second component. For floating guide units, the coupling unit can couple ends of different floating guide units. A coupling unit may couple the end of the float at the front of the trap to an end of a floating guide. Providing coupling units which couple other portions of the components may also be useful. The coupling unit can be fabricated from, for example, steel. Other types of materials which have sufficient mechanical strength may also be used.

[0037] The flexible coupling unit provides multiple degrees of freedom in movement between the coupled components. In one embodiment, the flexible coupling unit provides two degrees of freedom of movement between the coupled components. For example, coupled components can move along first and second directions with respect to each other. In one embodiment, the first and second directions are perpendicular to each other. In one embodiment, the first direction can be about parallel to the surface of the water and the second direction can be about perpendicular to the surface of the water. For example, one component can move up or

down as well as rotating side to side with respect to the other component. Enabling coupled components to move in different directions with respect to each other reduces stress created by changes in water currents and water levels. As a result, breakage in coupling between components is reduced, thereby improving reliability. Providing flexible coupling units which provide other degrees of freedom or configurations of first and second directions may also be useful.

[0038] Figs. 2a-b show side and top views of a floating mount 170 coupled to an end coupler 290. The end coupler, for example, is coupled to an end of a floating guide 252. As shown, the end coupler comprises a guide mount 291 and a mounting plate 292 with an opening 294. The floating mount includes a base plate 271. The base plate is mounted to, for example, the side of the waterway using bolts.

[0039] The base plate includes a track 279 along which a float unit 252 slidably moves. The float unit is designed to float on water. In one embodiment, the track comprises a T-shaped track. Providing tracks with other shapes may also be useful. The float unit includes a frame on which rollers 277 are mounted. The rollers maintain the float unit on the track. The rollers also facilitate sliding the float unit along the track. Upper and lower track stoppers 278a-b are provided on the track to prevent the float unit from moving out of the track.

[0040] A float mounting plate 272 is provided on the float mount unit and includes an opening 274. The openings in the mountings plates are mated together by, for example, a fastener, such as a bolt to couple the guide unit to the floating mount. The mounting plate of the end coupler can rotate around the fastener. To facilitate rotating the end coupler, the mounting plates comprise a semicircular shape. Other shapes may also be useful.

[0041] As the water level changes, the float unit automatically slides up or down the track to stay on the water surface. The use of a floating mount helps maintain the mount at the same level as the floating guide coupled thereto. This improves reliability of the system as well as debris trapping efficiency.

[0042] Figs. 3a-b shows a front and side views of a quick release mount unit 180. As shown, the mount unit includes a mount plate 371. The mount plate is mated to, for example, the side of the waterway using bolts. On the surface of the mount plate are provided rod guides 386. The rod guides are used to mount a release rod 383. For example, the release rod slides through the rod guides and are held in place. In one embodiment, the rod guides are fitted with friction rings 392. Various types of friction rings, for example rubber rings, can be used. The friction rings create friction with the release rod to temporarily hold it in place. Other techniques for temporarily holding the release rods in place are also useful.

[0043] In one embodiment, the mount rods are configured to create two independent coupling regions 384a-b. To create two independent couplings, in one embodiment, three rod guides are provided. The first and second rod guides 386a-b form the first coupling region and the second and third rod guides 386b-c form the second coupling region.

[0044] First and second cables 382a-b from the subsystems may be coupled to respective first and second coupling regions by putting the release rods through the eyes of the cables as it is inserted into the rod guides. The first cable, for example, is coupled to the trap of the first subsystem and the second cable is coupled to the second floating guide of the second subsystem. To release the second cable without releasing the first cable, the rod is raised so that it is no longer in the third rod guide but remains in the first and second rod guides. To release both cables, the rod can be pulled out of all the rod guides. As such, a subsystem can be quickly and easily released from the mount.

[0045] Fig. 4 shows an embodiment of an end coupler 290 of a flexible coupling unit. The end coupler, for example, is coupled to an end of a floating guide 252. As shown, the end coupler comprises a guide mount 291. The guide mount is, for example, mounted to an end of a floating guide, such as a boom. The end coupler further includes a mounting plate 292 attached to the guide mount. The mounting plate, in one embodiment, extends from the guide mount. The mounting plate is provided with an opening 294. The opening serves as a coupling point to,

for example, another mounting plate. In one embodiment, the mounting plate comprises a semicircular shape. The semicircular shape facilitates rotation around the opening when mated to another mounting plate. Providing a mounting plate with other shapes may also be useful. Although the end coupler, as shown, includes one mounting plate, it is understood that a plurality of mounting plates can be used. For example, two mounting plates can be aligned to form a stack of mounting plates.

[0046] Fig. 5a shows an embodiment of a flexible coupling unit 185. As shown, the flexible coupling unit couples first and second end couplers 290a-b of first and second floating guide units 152a-b together. In one embodiment, the flexible coupling unit comprises a base 540 with first and second major surfaces 544a-b. First and second mounting plates 591a-b are attached to respective first and second major surfaces. The mounting plates, for example, are semicircular in shape and include openings for mating to other mounting plates, such as mounting plates of the end couplers. Providing mounting plates having other shapes is also useful. The first and second mounting plates are rotated at an angle with respect to each other. In one embodiment, the mounting plates are offset by about 90° with respect to each other. Other offset angles may also be useful.

[0047] Fig. 5b shows another embodiment of a flexible coupling unit 185. The flexible coupling unit is similar to that of Fig. 5a except that each surface is provided with first and second mounting plates. For example, mounting plates 591a and 592a are attached to the first major surface 544a and mounting plates 591b and 592b are attached to the second major surface. The mounting plates of each major surface are aligned with each other and offset with respect to the mounting plates of the other major surface. In one embodiment, the mounting plates on one major surface are offset by about 90° with respect to the mounting plates on the other major surface. Other offset angles may also be useful.

[0048] Fig. 5c shows another embodiment of an end coupler 690 of a flexible coupling unit. In one embodiment, the end coupler comprises two identical or similar pieces which are mated

together for mounting to, for example, an end of a floating guide. For simplicity, only one of the pieces is shown. As shown, the end coupler piece comprises a guide mount 291a. Extending from the guide mount is a mounting plate 292a with an opening 294a. When mated with another piece, the end coupler includes two aligned mounting plates.

[0049] The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The foregoing embodiments, therefore, are to be considered in all respects illustrative rather than limiting the invention described herein. Scope of the invention is thus indicated by the appended claims, rather than by the foregoing description, and all changes that come within the meaning and range of equivalency of the claims are intended to be embraced therein.

What is claimed is:

CLAIMS

1. A debris collection system comprising:
a trap;
first and second floating guides, first ends of the floating guides coupled to corners of the trap for keeping the trap on a surface of a waterway; and
a release mount coupled to a second end of the second guide,
wherein the release mount enables release of the system, allowing navigation through the waterway while collecting debris.
2. The debris collection system of claim 1 comprises an adjustable mount coupled to a second end of the first guide.
3. The debris collection system of claim 2 wherein the adjustable mount is mounted to a first side of the waterway and the release mount is mounted to a second side of the waterway.
4. The debris collection system of claim 1 wherein the floating guides comprises floating booms.
5. The debris collection system of claim 4 wherein the floating booms are coupled together by a boom linker and a flexible joint.
6. The debris collection system of claim 4 wherein the boom comprises polyethylene pipe.
7. The debris collection system of claim 1 wherein the trap comprises a frame.

8. The debris collection system of claim 7 wherein the trap comprises wire mesh attached to the frame.
9. The debris collection system of claim 1 wherein the trap comprises a plurality of links at the corners of the trap.
10. The debris collection system of claim 9 wherein the link comprises a support plate with an opening.
11. The debris collection system of claim 1 comprises first and second bracket mounts mounted to first and second side of the waterway.