2021 Life Jacket Wear Rate Observation Study

Featuring

National Wear Rate Data from 1999 to 2021

YOUR BOATING DOLLARS AT WORK

Produced under a grant from the Sport Fish Restoration and Boating Trust Fund, administered by the U.S. Coast Guard

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National Wear Rate Data from 1999 to 2021

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JSI Research & Training Institute, Inc.
and
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AUXLWO

2021 marks the 6th year of USCG Auxiliary participation in this data collection effort. The AUXLWO (Auxiliary Life Jacket Wear Observation) program launched officially in 2018 by the Coast Guard Office of Auxiliary & Boating Safety (CG-BSX). To date, 260 individual Auxiliary members in 20 states have contributed to the study. **Thank you to all participants in these 20 states:**

Arizona, California, Florida, Georgia, Kansas, Louisiana, Maryland, Michigan, Minnesota, Missouri, New York, North Carolina, Oklahoma, Oregon, Rhode Island, South Carolina, Tennessee, Texas, Virginia, Wisconsin.

Special thanks for multiple years of leadership from:
Jeff Decker, USCG, Grant Technical Manager
Charles Hurley, USCG Auxiliary National Division Chief, AUXLWO
Bill Jefferson, Branch Chief- Special Programs Outreach East
Randy Wesson, Branch Chief- Special Programs Outreach West

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I. Introduction

This report provides data and analysis on the 2021 National Life Jacket Wear Rate Observation Study with comparison information from the previous twenty-one years' of studies (1999-2019). Life jacket wear rate data was not collected during the 2020 observation year due to the COVID-19 pandemic. Tracking changes in life jacket wear rates over time provides important statistics for those individuals and groups responsible for educating the public about boating safety, improving boating safety programs, and for legislative efforts targeting safety improvements for recreational boating. The 2020 Recreational Boating Statistics report, published by the United States Coast Guard (USCG), shows that among the 767 drowning deaths in 2020 where life jacket use or nonuse was known, 86% of the individuals were reported as not wearing a life jacket. These statistics make it essential to not only track the national life jacket wear rate among recreational boaters, but also to understand the circumstances and patterns in which life jackets are worn.

Calendar year 2021 marked the twenty-second year of life jacket wear rate data collection efforts conducted by JSI Research & Training Institute. The cumulative years of data allow for a higher level of analysis (i.e., controlling for the impact of influencing factors like age, weather, and boat type) in order to unmask potential trends and indicators of increased or decreased life jacket wear among different groups of recreational boaters.

Beginning April 1, 2021, Congress passed a law requiring the use of an engine cut-off switch (ECOS) for operators of powered recreational vessels less than 26 feet in length. In order to capture use of ECOS, JSI added an additional ECOS data collection point to the data collection forms. ECOS status is collected for all powerboats regardless of size. The initial findings for ECOS data collection are provided in this report.

Most information in this report is presented separately for adults (18+ years old) and youth (0 to 17 years old) since wear rates are substantially different for these two groups. Over the twenty-one years of the presented data, the general distributions of age, gender, boat types, boat characteristics, and site characteristics have remained relatively stable. The appendix contains a detailed description of methods used and proportions of various boaters; boat and site characteristics are shown for the 1999-2021 period of data collection

II. National Core Data Results

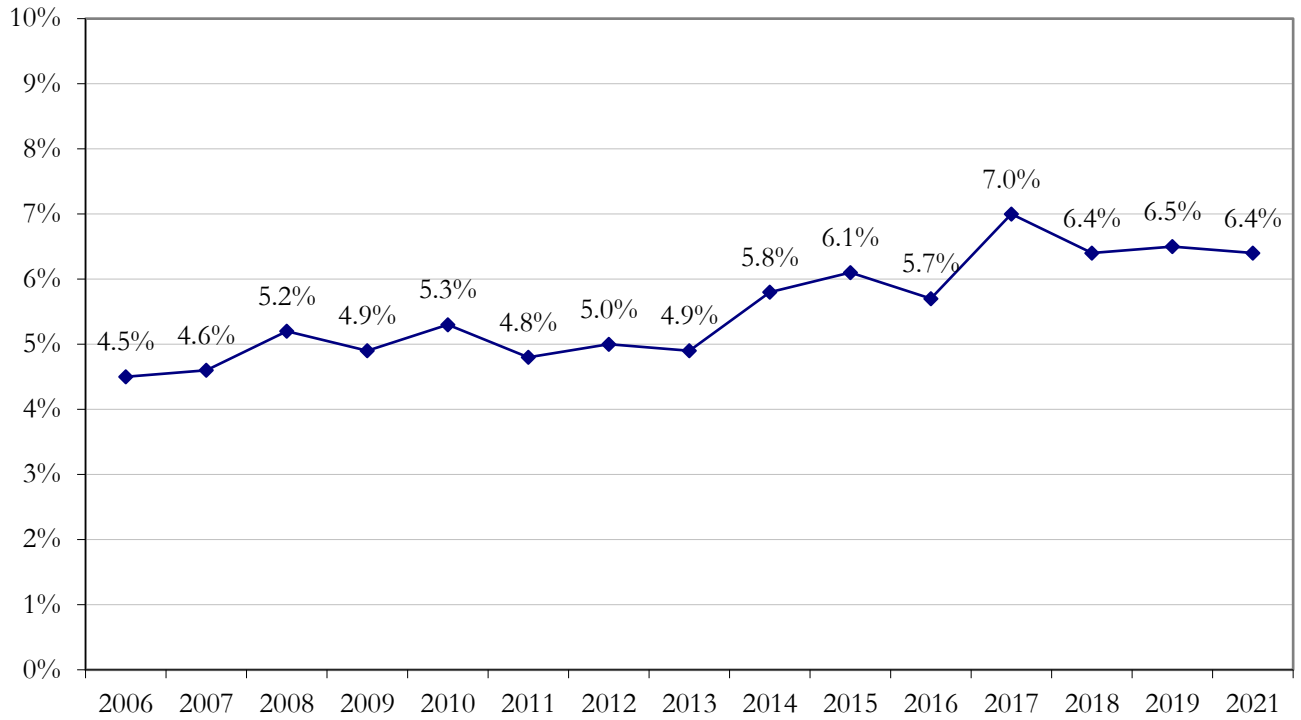
Adult Life Jacket Wear Rates on Open Motorboats 2006 to 2021

The National Boating Safety Advisory Council (NBSAC) recommended the creation of a strategic plan for the National Recreational Boating Safety Program in 2005. The goals, objectives, and strategies in this Plan can help all partners in boating safety work together to reduce the incidents of preventable deaths, injuries, and property damage. One of the objectives of all of the Strategic Plans, since the 2005 Strategic Plan, is to increase the observed life jacket wear rate of adults in open motorboats. For the purposes of this measurement, "open motorboats" are a combination of the skiff/utility (hereafter as "skiffs") and runabout/speedboat (hereafter as "speedboats") categories that are individually presented later in this report. This objective was put in place beginning in 2006.

To ensure that comparisons to 2006 and each subsequent year are valid, the proportion of skiffs to speedboats in each state for each subsequent year was set to mirror the proportions found in 2006 since the wear rates for skiffs are generally greater than those for speedboats. For example, in 2006 the national proportion across all states of the number of skiffs to the number of speedboats was 22% versus 78%, but in 2011 the proportions were 31% to 69%. If proportions of these boat categories were not adjusted, the 2011 combined wear rate would appear more positive simply because JSI observed more skiffs relative to speedboats that year than in 2006. Similarly, the proportions are likely to fluctuate each year in each state.

Weighting each state's data to correspond to the 2006 state ratios, the adult wear rate for open motorboats in 2021 is 6.4% and it represents a generally improving trend since 2006. (See Figure A for a chart showing these trends and also Table 2.2 on page 14.) Since 2006 the wear rates for open motorboats have shown a relative increase by 42% since 2006 going from 4.5% to 6.4%.

Figure A – Adult Wear Rates on Open Motorboats* 2006-2021
(Weighted to 2006 Skiff-Speedboat Proportions for Each State)



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* The Open Motorboat category is created by grouping "skiffs" and "speedboat/runabouts" together. Two factors are controlled for in this chart: Age (proportions of 18 to 64 and 65+ adults), and the proportion of skiffs to speedboat/runabouts, which has been set each year within each state to reflect the proportions observed in 2006, the year in which the Strategic Plan goals were first measured. In addition, each state's contribution to the national average is weighted to reflect the 2006 proportions.

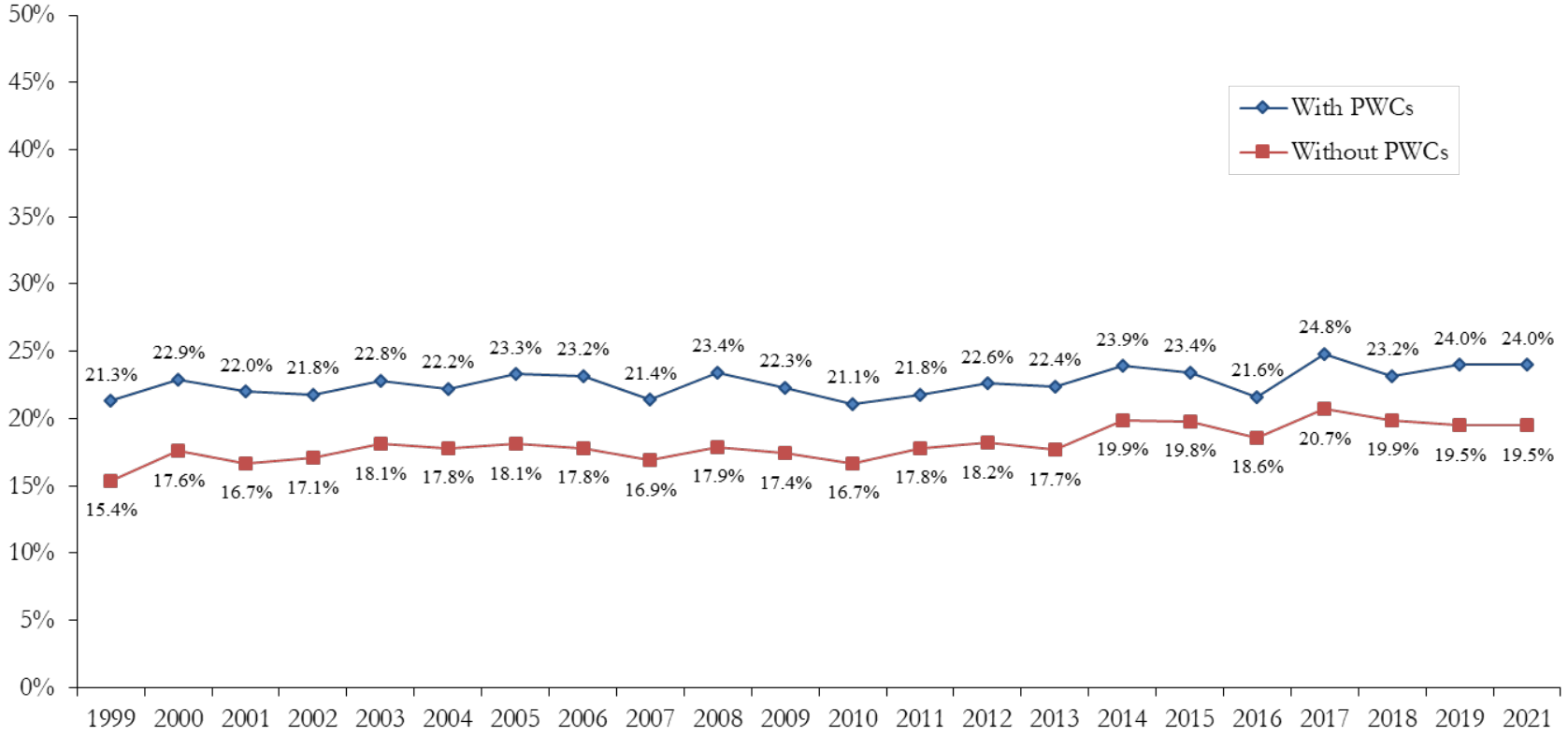
National Life Jacket Wear Rates for ALL Boaters 1999 to 2021

Figure B shows trends for national life jacket wear rates, including all groups of recreational boaters together (youth and adults) for two groups of boats - "all boats" and "all boats except PWCs". The two sets of data present a clear indication of the impact of PWCs (personal watercraft) on the overall average wear rates. In subsequent tables in this report JSI removed PWCs from the findings since this will provide a more valid representation of the trends in voluntary wear rates, since life jacket wear is mandated for operators and passengers of PWCs in almost all the states where observations occur (the exception is Alaska for adults).

The average life jacket wear rate for all boats and boaters combined for 2021 was 24.0%. This is a relative increase of 13% since the beginning of the study.

The 2021 average wear rate excluding PWCs was 19.5%, which represents a relative increase of 27% since 1999 (15.4%).

Figure B – Life Jacket Wear Rates for ALL Boaters



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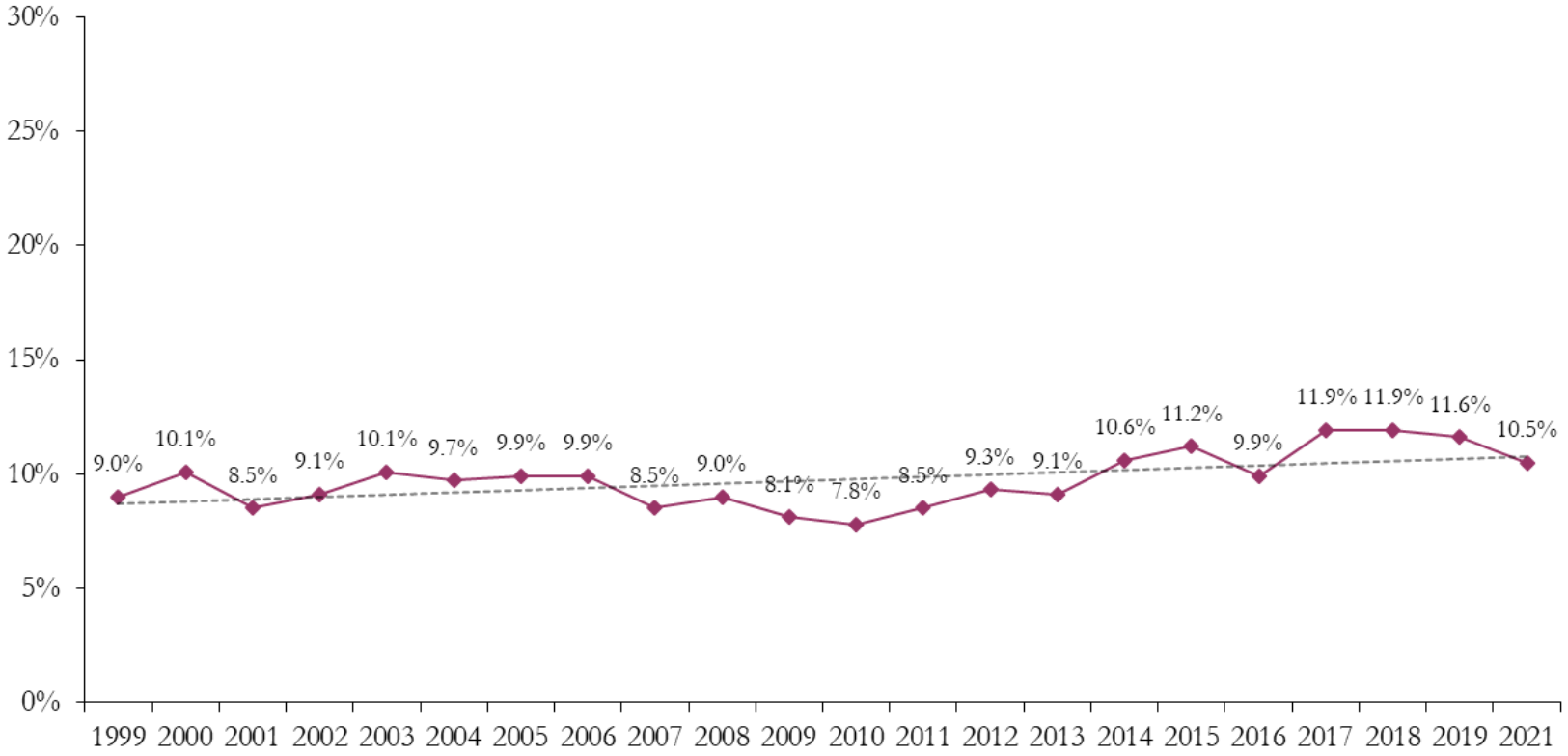
*Factors controlled for: Age & Boat Type.

National Life Jacket Wear Rates for ADULTS (18 years or older) 1999 to 2021

Figure C and Table 2.1 show the national wear rate trend for all adults on all boats excluding PWCs. The national average wear rate for all adults in 2021 was 10.5%. The 2021 rate represents a 17% relative increase since 1999 (9.0%) and a 35% relative increase since 2010 (7.8%). The 2021 rate shows a short trend since 2017 in small declines in adult wear rates.

Figure C – Life Jacket Wear Among Adult Boaters*
(All boats except PWCs)



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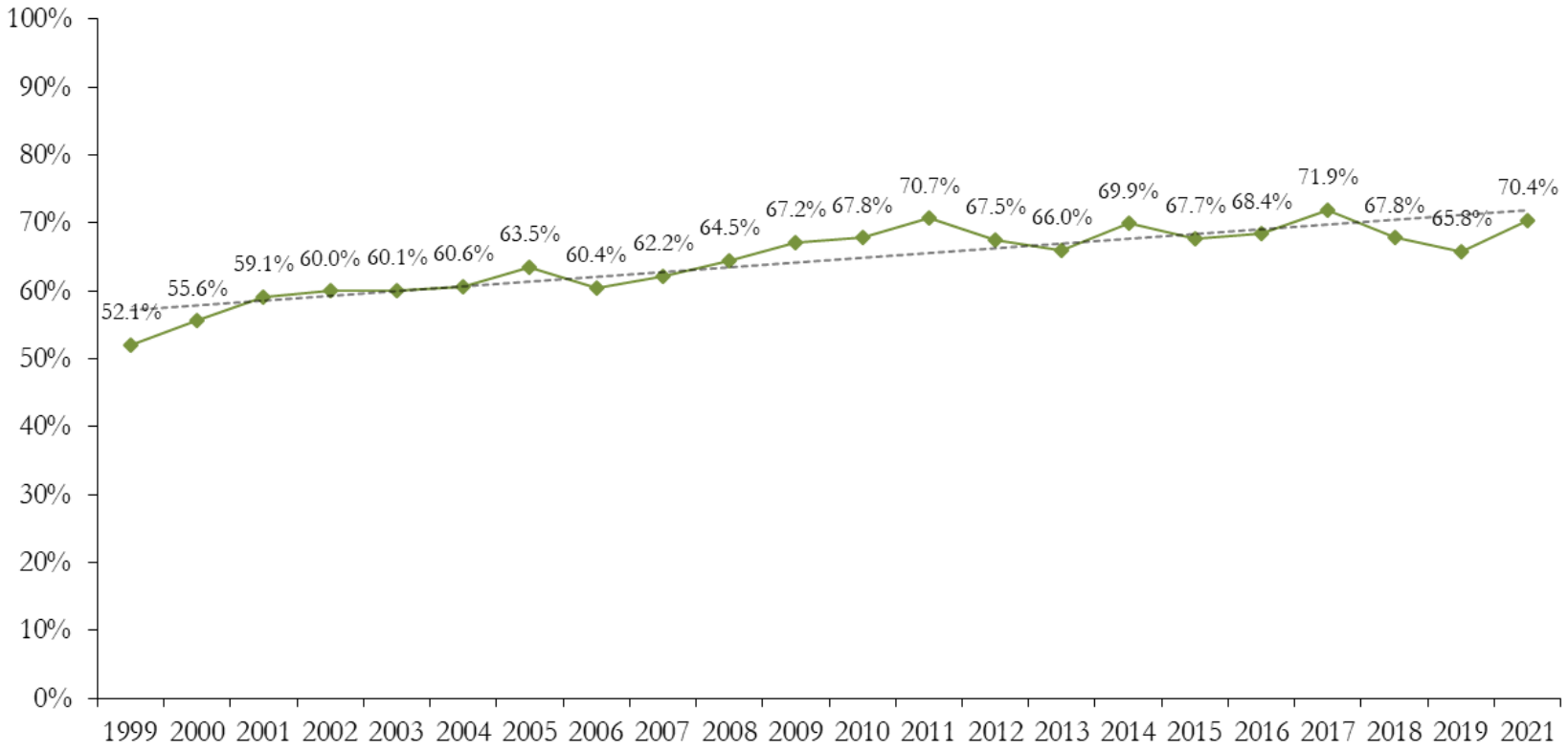
*Factors controlled for: Age & Boat Type.

National Life Jacket Wear Rates for YOUTH (17 years or younger) 1999 to 2021

Figure D and Table 2.1 show the national wear rate trend for all youth (17 years or younger) on all boats except PWCs. These rates are relatively high across the twenty-one years of data shown, with a general upward trend. The wear rate for 2021 is 70.4%. This is a relative increase of 35% since the beginning of the study in 1999 (52.1%).

Figure D – Life Jacket Wear Among Youth Boaters*
(All boats except PWCs)



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*Factors controlled for: Age & Boat Type.

Life Jacket Wear Rates by Age Categories 1999 to 2021

Table 2.1 presents wear rates by the different age categories captured in the study.

The youth (0-17) wear rate for 2021 was 70.4%, a 35% relative increase since 1999 (56.0%). Wear rates for the under 6 age group have always been high; the 2021 rate of 91.3% represents a 13% relative increase since 1999 (87.8). Wear rates for the 6-12 year olds were 88.6% and represent a 28% relative increase since 1999(73.1%). Teenagers (13-17) wear rates of 40.7% represents a 69% relative increase since 1999 (28.9%).

For adults ages 18 to 64, the 2021 wear rate is 10.3%. This is the second highest rate recorded to date and represents a 17% relative increase since 1999 (8.8%).

For adults 65 years of age and older, the 2021 data show a wear rate of 14.6%.

As indicated in Figure C and in Table 2.1, for the combined adult group (18+ years), there has been a relative increase in wear rates of 17% since 1999 (9.0% to 10.5%).

Table 2.1 – Life Jacket Wear Rates by Age Excluding Boaters on PWCs*

Age	Observation Year																	
	1999-2001 % (N's)	2002-2004 % (N's)	2005 % (N's)	2006 % (N's)	2007 % (N's)	2008 % (N's)	2009 % (N's)	2010 % (N's)	2011 % (N's)	2012 % (N's)	2013 % (N's)	2014 % (N's)	2015 % (N's)	2016 % (N's)	2017 % (N's)	2018 % (N's)	2019 % (N's)	2021 % (N's)
0-5 yrs	87.8% (1919)	91.9% (2077)	93.1% (714)	94.4% (921)	92.2% (930)	93.5% (938)	93.6% (854)	94.8% (811)	96.6% (874)	94.7% (662)	93.5% (789)	94.5% (804)	92.1% (694)	92.9% (573)	94.1% (555)	90.4% (615)	93.2% (790)	91.3% (368)
6-12 yrs	73.1% (7922)	81.3% (32790)	80.6% (2487)	79.1% (2403)	84.1% (2819)	87.3% (2579)	86.5% (2812)	89.1% (2809)	90.7% (2381)	84.9% (2844)	85.4% (2494)	87.3% (2757)	87.2% (2227)	84.1% (2184)	87.3% (2131)	86.2% (2575)	82.2% (2473)	88.6% (1889)
13-17 yrs	28.9% (7862)	31.4% (7914)	32.8% (2230)	33.5% (2403)	31.5% (2652)	33.2% (2507)	38.9% (2420)	35.1% (2127)	41.4% (1817)	37.6% (2163)	34.9% (1933)	41.6% (1837)	37.2% (1694)	41.5% (1675)	46.5% (2077)	38.3% (2138)	38.9% (2176)	40.7% (2099)
0-17 yrs (all youth)	56.0% (17413)	60.2% (17849)	63.5% (5414)	60.4% (5713)	62.2% (6401)	64.5% (6024)	67.2% (6086)	67.8% (5747)	70.7% (5072)	67.5% (5669)	66.0% (5216)	69.9% (5398)	67.7% (4615)	68.4% (4432)	71.9% (4763)	67.8% (5328)	65.8% (5439)	70.4% (4356)
18-64 yrs	9.1% (83949)	9.7% (93612)	9.9% (30176)	10.0% (29591)	8.4% (32108)	9.1% (30743)	8.1% (34632)	7.7% (36420)	8.5% (33267)	9.2% (32298)	9.1% (30843)	10.4% (33058)	11.1% (31012)	9.9% (30906)	11.9% (29760)	11.9% (34246)	11.6% (32918)	10.3% (26365)
65+ yrs	9.8% (3463)	8.3% (3359)	11.0% (823)	8.3% (803)	11.7% (881)	6.1% (1190)	7.0% (1129)	10.7% (763)	7.2% (951)	11.8% (1122)	6.9% (1091)	13.3% (1634)	12.3% (1232)	11.0% (1339)	12.2% (1134)	11.7% (975)	12.0% (1078)	14.6% (1522)
18+ yrs (all adults)	9.2% (87412)	9.6% (96971)	9.9% (30999)	9.9% (30394)	8.5% (32989)	9.0% (31933)	8.1% (35761)	7.8% (37003)	8.5% (34218)	9.3% (33420)	9.1% (31934)	10.6% (34692)	11.2% (32244)	9.9% (32245)	11.9% (30894)	11.9% (35221)	11.6% (33996)	10.5% (27887)

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*Factors controlled for: Age & Boat Type.

Powerboats for Adults (18 years or older)

Figure E and Table 2.2 present information for all powerboats for adults. The 2021 rate for all powerboats is 5.1%, a relative increase of 16% compared to 1999 rates (4.4%). However, rates for specific powerboat types all decreased from 2019 levels (5.5% to 5.1%).

Figure E – Adult Wear Rates for ALL Powerboats Except PWCs*

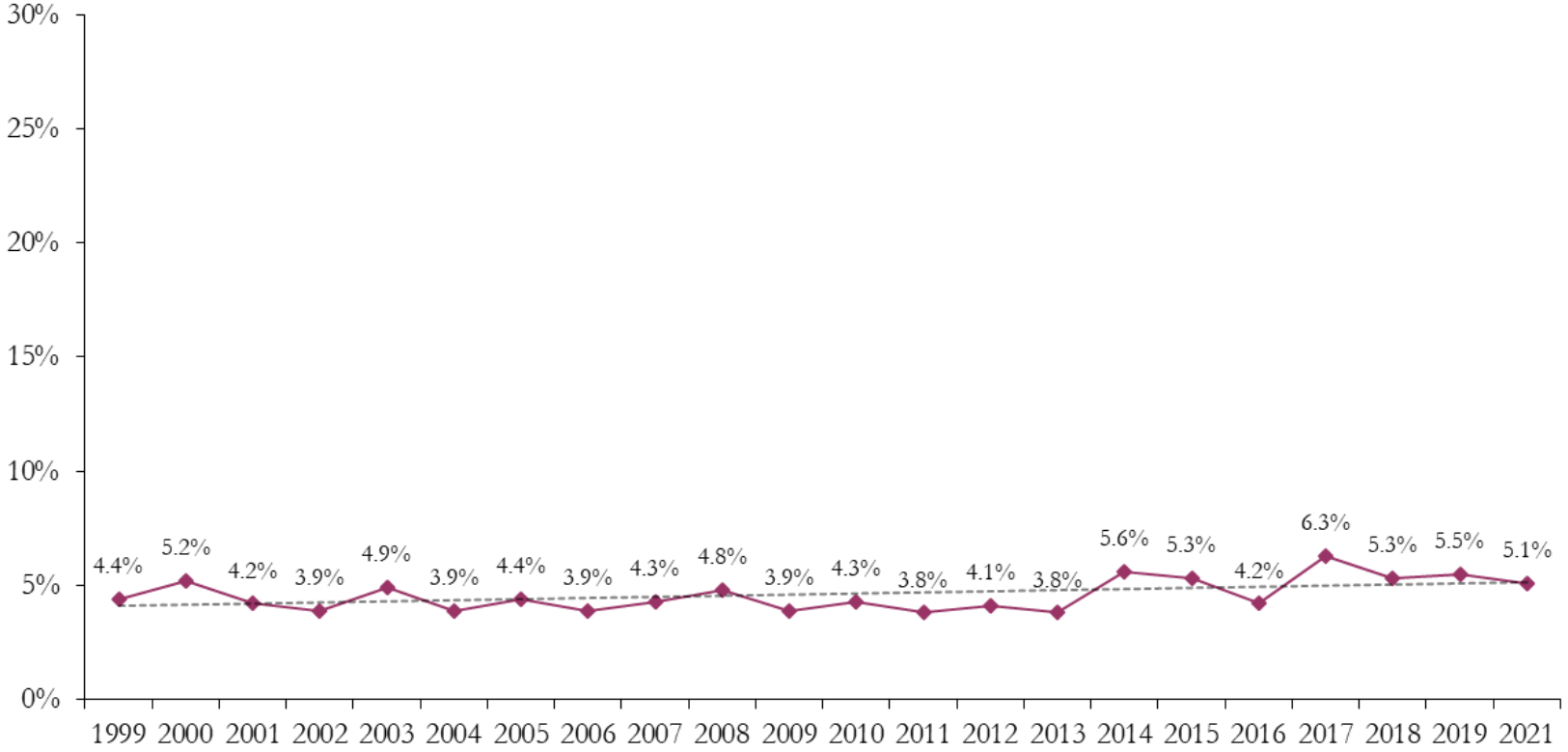

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Table 2.2 - Life Jacket Wear Rates by Powerboats for Adults*

Boat Type	Observation Year																	
	1999-2001 % (N's)	2002-2004 % (N's)	2005 % (N's)	2006 % (N's)	2007 % (N's)	2008 % (N's)	2009 % (N's)	2010 % (N's)	2011 % (N's)	2012 % (N's)	2013 % (N's)	2014 % (N's)	2015 % (N's)	2016 % (N's)	2017 % (N's)	2018 % (N's)	2019 % (N's)	2021 % (N's)
All Powerboats (no PWC's)	4.6% (70206)	4.2% (78779)	4.4% (25741)	3.9% (25412)	4.3% (27623)	4.8% (27315)	3.9% (29924)	4.3% (30894)	3.8% (28954)	4.1% (27890)	3.8% (26786)	5.6% (28766)	5.3% (26444)	4.2% (26774)	6.3% (25823)	5.3% (29602)	5.5% (28792)	5.1% (23561)
Skiff/Utility	10.0% (6239)	8.3% (11820)	7.2% (5038)	7.3% (4091)	8.5% (5340)	9.2% (6633)	6.9% (7257)	9.7% (6634)	8.2% (6530)	7.8% (6936)	6.4% (7231)	13.1% (6776)	10.2% (6592)	7.4% (7338)	10.8% (7558)	10.8% (8407)	9.0% (8946)	8.2% (7392)
Runabout/ Speedboat	4.7% (44643)	4.2% (43756)	4.7% (13643)	3.7% (14512)	3.6% (14414)	4.1% (13901)	3.5% (14635)	3.2% (15093)	3.0% (14381)	3.3% (13441)	3.5% (11686)	3.5% (13040)	4.1% (11853)	3.5% (11736)	4.6% (10192)	3.4% (11277)	4.1% (11083)	3.9% (8766)
Runabout/ Speedboat (excluding towed participants)	4.0% (44332)	3.5% (43409)	3.7% (13480)	2.8% 14376)	2.9% (14313)	3.1% (13744)	2.5% (14481)	2.2% (14947)	2.3% (14279)	2.3% (13294)	2.4% (11554)	2.6% (12923)	3.5% (11766)	2.7% (11638)	3.7% (10101)	3.0% (11218)	3.5% (10998)	3.3% (8706)
Open Motorboats**	5.8% (50882)	5.1% (55566)	5.3% (18681)	4.5% (18603)	4.6% (19754)	5.2% (20534)	4.9% (21892)	5.3% (21727)	4.8% (20911)	5.0% (20377)	4.9% (18917)	5.8% (19816)	6.1% (18445)	5.7% (19074)	7.0% (17750)	6.4% (19684)	6.5% (20029)	6.4% (16158)
Cabin Cruiser	1.5% (14009)	1.6% (17472)	1.1% (5054)	1.7% (4280)	2.0% (5353)	1.4% (4430)	1.6% (5342)	1.5% (5900)	1.6% (5085)	1.6% (4611)	1.0% (4719)	2.2% (4669)	2.7% (4782)	1.4% (4418)	3.9% (4301)	1.1% (4920)	2.8% (4183)	2.7% (2839)
Houseboat	0.2% (529)	2.0% (668)	0.4% (219)	0.0% (112)	0.0% (43)	0.0% (51)	0.0% (31)	0.0% (140)	1.2% (309)	0.0% (18)	0.0% (51)	0.8% (131)	1.6% (64)	0.0% (93)	0.0% (32)	0.0% (63)	0.0% (85)	0.0% (55)
Pontoon	3.8% (4618)	2.8% (5176)	4.1% (1849)	2.4% (2276)	2.7% (2150)	1.1% (2051)	2.1% (2436)	1.5% (2922)	1.4% (2734)	2.3% (2624)	1.4% (2917)	2.4% (3966)	2.6% (2961)	1.5% (3080)	3.4% (3438)	3.3% (4695)	2.3% (4237)	2.4% (4291)
PWC	95.8% (5751)	95.4% (5108)	95.3% (1858)	97.1% (1962)	96.1% (1736)	97.6% (2009)	97.4% (2093)	97.5% (1921)	97.7% (1524)	96.9% (1811)	96.3% (1905)	96.9% (1856)	97.6% (1501)	95.6% (1256)	97.9% (1625)	97.4% (1483)	97.0% (1960)	97.0% (1673)
Powered Inflatable/ Raft	17.1% (697)	16.0% (555)	1.9% (157)	11.0% (253)	19.1% (366)	17.6% (228)	11.9% (254)	16.7% (345)	14.3% (224)	14.1% (278)	27.2% (233)	22.9% (315)	12.8% (256)	23.8% (223)	13.1% (334)	13.1% (303)	26.8% (343)	15.0% (273)

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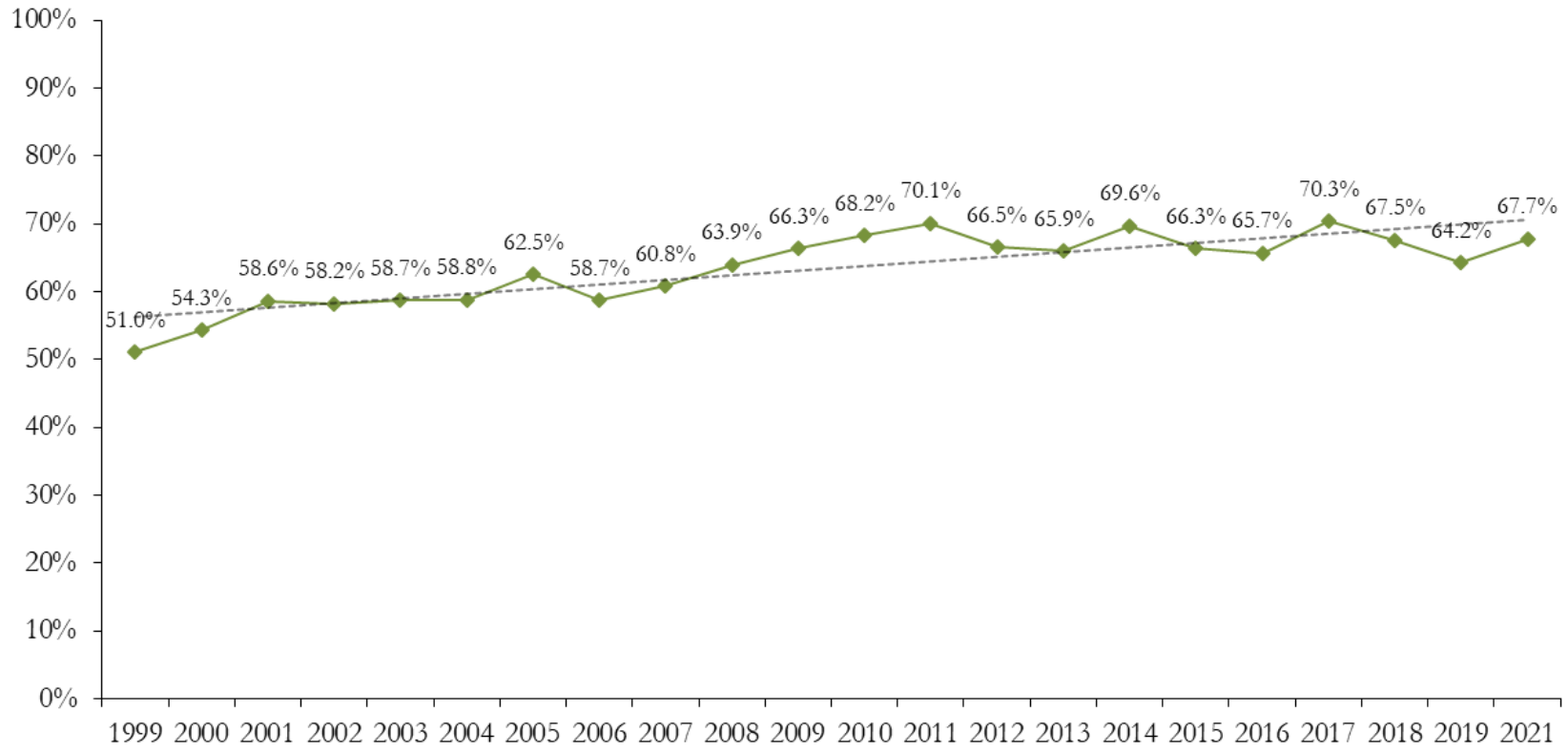
*Factors controlled for: Age & Boat Type.
** The Open Motorboat category was created by grouping "skiffs" and "speedboat/runabouts" together. Factors controlled for in this line of the chart are Age (proportions of 18 to 64 and 65+ adults) and the proportion of skiffs to speedboat/runabouts has been set in each year within each state to reflect the proportions observed in 2006, the year in which the Strategic Plan goals were first measured. In addition, each state's contribution to the national average was weighted to reflect the 2006 proportion.

Powerboats for Youth (17 years or younger)

Figure F and Table 2.3 present data for all powerboats for the three age groups of youth combined (17 years or younger). Wear rates for youth had generally increased over the years however; they have leveled off since 2012. The 2021 wear rate is 67.7%, a relative increase of 33% since 1999 (51.0%). Pontoon boats have had the largest increase in wear rates for youth over the life of this project. Even though individual years may not always show increases from previous years, on all types of boats, wear rates have improved since 1999 for youth.

Figure F – Youth Wear Rates for ALL Powerboats Except PWCs*



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*Factors controlled for: Age & Boat Type.

Table 2.3 – Life Jacket Wear Rates by Powerboats for Youth*

Boat Type	Observation Year																	
	1999-2001 % (N's)	2002-2004 % (N's)	2005 % (N's)	2006 % (N's)	2007 % (N's)	2008 % (N's)	2009 % (N's)	2010 % (N's)	2011 % (N's)	2012 % (N's)	2013 % (N's)	2014 % (N's)	2015 % (N's)	2016 % (N's)	2017 % (N's)	2018 % (N's)	2019 % (N's)	2021 % (N's)
All Powerboats (no PWCs)	55.1% (14730)	58.6% (15523)	62.5% (4737)	58.7% (5043)	60.8% (5583)	63.9% (5257)	66.3% (5451)	68.2% (5090)	70.1% (4589)	66.5% (4846)	65.9% (4546)	69.6% (4798)	66.3% (4028)	65.7% (3750)	70.3% (4118)	67.5% (4762)	64.2% (4820)	67.7% (3681)
Skiff/Utility	57.6% (1148)	60.0% (1966)	63.3% (781)	58.4% (661)	63.1% (947)	68.4% (988)	70.4% (1097)	68.1% (862)	75.4% (929)	65.1% (1022)	66.3% (936)	70.8% (901)	68.2% (948)	65.6% (871)	73.7% (980)	68.4% (1116)	66.0% (1088)	68.8% (1017)
Runabout/ Speedboat	55.6% (10507)	59.8% (10422)	63.5% (2966)	60.9% (3348)	61.7% (3517)	64.6% (3256)	68.2% (3133)	69.7% (2943)	71.0% (2624)	69.9% (2744)	69.2% (2482)	70.5% (2696)	68.1% (2121)	66.3% (1934)	70.6% (2019)	67.% (22929)	65.1% (2536)	67.4% (1641)
Open Motorboats** (Skiff/Utility/ Runabout/ Speedboat)	55.8% (11655)	59.8% (12388)	63.5% (3747)	60.5% (4009)	61.9% (4464)	65.2% (4244)	68.6% (4230)	69.5% (3805)	71.6% (3553)	69.1% (3766)	68.7% (3418)	70.6% (3597)	68.2% (3069)	66.6% (2805)	71.2% (2019)	68.0% (3345)	65.2% (3624)	67.7% (2658)
Cabin Cruiser	46.9% (1106)	48.5% (1878)	54.6% (528)	50.7% (501)	52.0% (639)	51.0% (581)	51.2% (644)	58.8% (524)	61.6% (507)	50.6% (465)	48.9% (505)	56.6% (364)	58.9% (430)	58.7% (409)	59.7% (473)	49.1% (459)	50.6% (400)	55.2% (279)
Houseboat	15.2% (154)	22.6% (128)	12.9% (38)	28.2% (40)	. (5)	. (1)	. (4)	19.1% (18)	39.9% (19)	. (3)	. (1)	. (2)	. (10)	. (8)	. (1)	. (4)	. (2)	. (0)
Pontoon	47.8% (1106)	52.0% (1131)	64.6% (440)	50.3% (505)	64.1% (414)	65.9% (392)	66.2% (530)	68.4% (716)	65.7% (494)	67.3% (580)	66.7% (598)	71.9% (787)	63.2% (511)	65.5% (508)	72.2% (606)	75.0% (908)	65.8% (758)	72.8% (721)
PWC	98.2% (1891)	98.4% (1607)	98.3% (652)	99.2% (580)	98.7% (522)	99.4% (664)	98.6% (572)	99.4% (427)	99.1% (376)	98.7% (401)	98.0% (371)	99.7% (365)	99.0% (292)	98.7% (154)	98.2% (275)	99.3% (269)	99.3% (402)	99.6% (245)
Powered Inflatable/ Raft	69.4% (190)	68.1% (126)	71.2% (22)	70.6% (28)	71.1% (66)	79.7% (39)	70.3% (47)	78.2% (45)	73.1% (35)	58.5% (35)	65.4% (25)	68.9% (50)	69.5% (18)	84.0% (28)	68.9% (40)	71.4% (50)	80.6% (38)	58.0% (23)

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*Factors controlled for: Age & Boat Type.
** The Open Motorboat category was created by grouping "Skiffs" and "Speedboat/Runabouts" together. The proportion of Skiffs to Speedboat/Runabouts has been set to reflect the national proportions observed in 2006, the year in which the Strategic Plan goals were first measured. In addition, JSI controls for age of youth as JSI does for the other boat types in this table.

Paddlecraft for Adults (18 years or older)

Table 2.4 presents results for adults in all types of paddlecraft and Figure G shows the trends for all paddlecraft excluding standup paddleboards (since this boat type began to be counted in 2010). The 2021 rates for all paddlecraft excluding standup paddleboards is 53.2%, representing a relative increase of 13% from 1999 (46.2%) rates and a relative decrease of 14% from the previous observation year (2019, 61.9%). These changes in rates should be viewed with caution, since paddlecraft activity is mostly observed at only a few sites– mainly the Provo River in Utah where lifejacket use is mandatory and the Illinois River in Oklahoma, where lifejacket use is traditionally very low. Uneven changes from year to year are highly influenced by the relative number of boaters observed at these two sites.

In 2015, JSI added two rows of data to Table 2.4. One for standup paddleboards (first observed in 2010) and one for an all paddlecraft wear rate including standup paddleboards. The number of boaters observed has increased since 2010 and wear rates for standup paddleboards have exceeded 50% since 2012 (56.1%), and the 2021 rate of 52.7% represents a 90% relative increase since 2010 (35.4%).

Figure G – Adult Wear Rates for ALL Paddlecraft (excluding Paddleboards)*

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*Factors controlled for: Age & Boat Type.

Table 2.4 – Life Jacket Wear Rates by Paddlecraft for Adult*

Boat Type	Observation Year																	
	1999-2001 % (N's)	2002-2004 % (N's)	2005 % (N's)	2006 % (N's)	2007 % (N's)	2008 % (N's)	2009 % (N's)	2010 % (N's)	2011 % (N's)	2012 % (N's)	2013 % (N's)	2014 % (N's)	2015 % (N's)	2016 % (N's)	2017 % (N's)	2018 % (N's)	2019 % (N's)	2021 % (N's)
All Paddlecraft (excluding SUPs)	49.7% (5168)	54.1% (5173)	47.0% (1616)	62.8% (1456)	40.1% (2065)	43.1% (1523)	41.4% (1939)	35.4% (2551)	46.5% (1608)	56.1% (2015)	46.0% (1919)	47.9% (2555)	51.0% (2531)	44.6% (2391)	57.4% (2251)	57.0% (2353)	61.9% (2086)	53.2% (2117)
Paddled Inflatable/ Raft	50.4% (622)	61.4% (880)	76.0% (225)	77.8% (308)	23.9% (526)	38.4% (311)	8.2% (340)	6.9% (813)	10.9% (324)	39.4% (485)	15.8% (271)	18.2% (337)	39.1% (455)	28.2% (371)	45.9% (354)	41.7% (247)	74.0% (209)	38.6% (516)
Rowboat/ Dinghy	27.0% (319)	23.9% (348)	59.2% (71)	26.7% (78)	15.0% (92)	23.0% (65)	35.3% (51)	34.8% (46)	34.3% (87)	60.2% (35)	17.8% (75)	29.0% (79)	22.1% (37)	40.2% (56)	43.0% (73)	32.3% (64)	11.0% (74)	8.4% (62)
Canoe	24.7% (2273)	23.8% (1930)	14.8% (679)	29.2% (364)	19.4% (764)	19.7% (481)	25.0% (758)	19.1% (994)	37.4% (386)	32.7% (438)	35.7% (569)	24.9% (744)	30.0% (716)	14.6% (605)	30.0% (532)	28.1% (677)	23.6% (498)	32.6% (360)
Kayak	84.3% (1954)	84.7% (2015)	74.1% (675)	77.9% (706)	72.0% (683)	65.5% (648)	72.6% (790)	75.9% (698)	68.6% (811)	74.9% (1056)	67.9% (1004)	74.9% (1395)	70.7% (1323)	71.5% (1359)	71.3% (1292)	75.6% (1365)	78.1% (1305)	64.1% (1179)
Canoe/Kayak Combined	52.5% (4227)	55.0% (3945)	44.4% (1354)	61.2% (1070)	44.3% (1447)	46.0% (1129)	49.1% (1548)	47.3% (1692)	49.4% (1197)	52.8% (1494)	50.9% (1573)	51.9% (2139)	51.6% (2039)	47.3% (1964)	52.3% (1824)	55.4% (2042)	56.1% (1803)	48.1% (1539)
Paddleboards (SUPs)	.	.	.	.	.	.	.	27.8% (54)	41.7% (84)	52.9% (157)	58.7% (264)	53.9% (397)	52.0% (348)	54.6% (407)	50.9% (509)	55.3% (492)	50.3% (457)	52.7% (406)
All Paddlecraft (including SUPs)	.	.	.	.	.	.	.	35.5% (2605)	46.0% (1692)	55.0% (2171)	45.4% (2183)	48.7% (2952)	51.1% (2879)	46.0% (2798)	56.2% (2760)	56.7% (2845)	59.8% (2543)	53.1% (2523)

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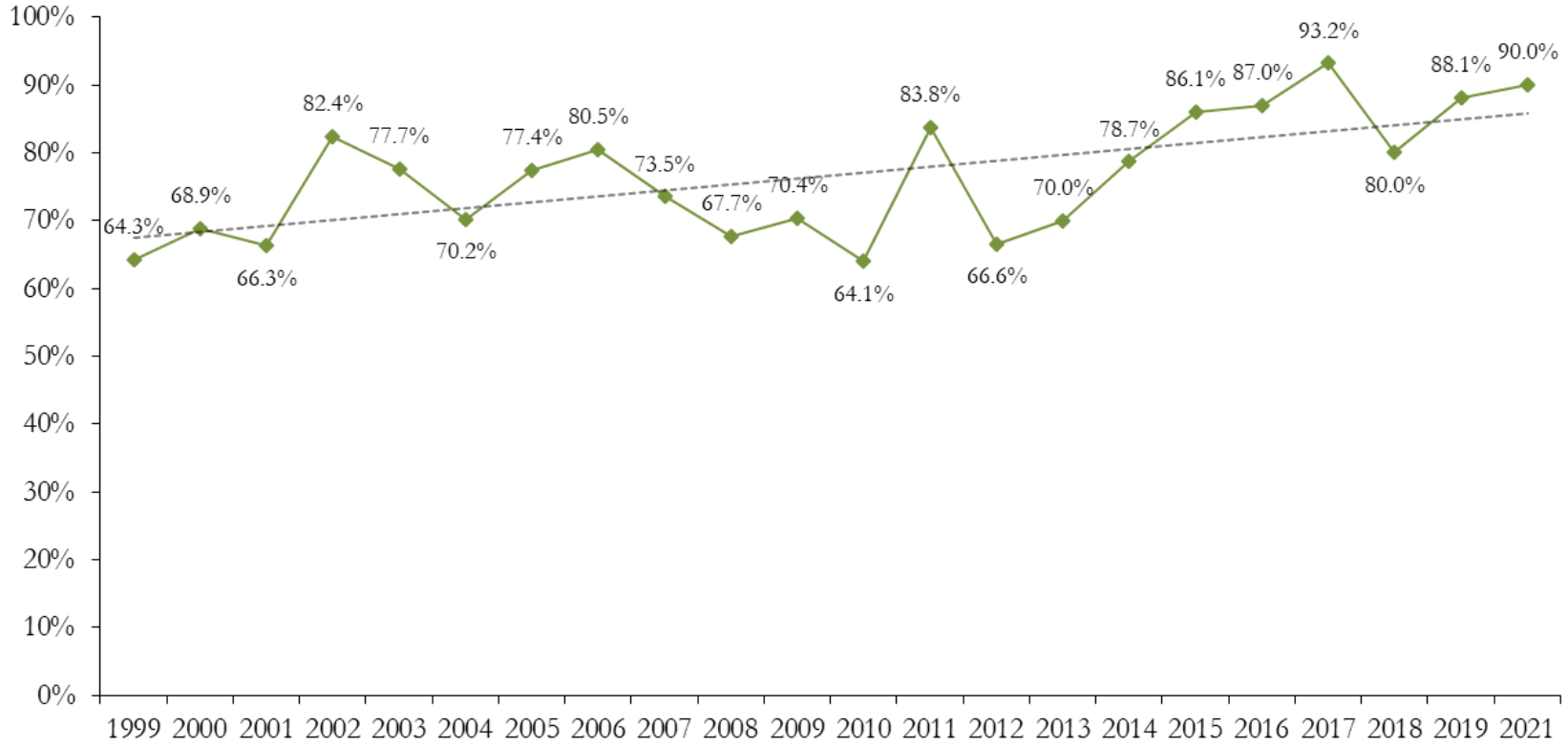
*Factors controlled for: Age & Boat Type.

Paddlecraft for Youth (17 years or younger)

Figure H and Table 2.5 present results for youth in paddlecraft. Data in this table should be viewed with caution because of the relatively small number of youth who use these types of craft. For all paddlecraft combined excluding standup paddleboards, the wear rate in 2021 was 90.0%, the second the highest wear rate ever observed and represents a 40% relative increase since 1999 (64.3%).

Figure H – Youth Wear Rates for ALL Paddlecraft*



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*Factors controlled for: Age & Boat Type.

Table 2.5 – Life Jacket Wear Rates by Paddlecraft for Youth*

Boat Type	Observation Year																	
	1999-2001 % (N's)	2002-2004 % (N's)	2005 % (N's)	2006 % (N's)	2007 % (N's)	2008 % (N's)	2009 % (N's)	2010 % (N's)	2011 % (N's)	2012 % (N's)	2013 % (N's)	2014 % (N's)	2015 % (N's)	2016 % (N's)	2017 % (N's)	2018 % (N's)	2019 % (N's)	2021 % (N's)
All Paddlecraft (excluding SUPs)	66.8% (1231)	76.5% (1044)	77.4% (281)	80.5% (225)	73.5% (520)	67.7% (487)	70.4% (319)	64.1% (419)	83.8% (231)	66.6% (476)	70.0% (371)	78.7% (337)	86.1% (340)	87.0% (389)	93.2% (414)	80.0% (327)	88.1% (303)	90.0% (530)
Paddled Inflatable/ Raft	52.4% (359)	76.7% (367)	77.5% (79)	77.9% (87)	58.4% (244)	55.6% (218)	59.0% (76)	41.9% (139)	68.5% (49)	50.2% (192)	55.1% (98)	68.7% (100)	83.5% (112)	84.4% (119)	85.0% (127)	69.7% (88)	89.7% (73)	94.0% (293)
Rowboat/ Dinghy	48.9% (56)	66.6% (63)	77.1% (17)	67.3% (26)	61.0% (21)	77.8% (25)	. (9)	. (14)	94.0% (15)	. (10)	. (10)	74.2% (23)	. (4)	99.3% (15)	. (3)	. (6)	. (5)	. (6)
Canoe	66.1% (545)	68.2% (374)	69.4% (101)	68.9% (49)	81.0% (123)	78.0% (158)	70.6% (132)	68.0% (169)	95.2% (82)	66.5% (89)	78.0% (139)	78.4% (87)	82.1% (61)	70.0% (57)	92.6% (102)	71.5% (105)	77.2% (43)	80.0% (66)
Kayak	89.1% (271)	89.9% (240)	88.7% (94)	89.0% (63)	90.1% (132)	83.5% (86)	85.3% (102)	85.4% (97)	89.3% (85)	84.8% (185)	77.0% (124)	90.7% (127)	91.9% (163)	85.4% (198)	94.5% (182)	90.6% (128)	89.9% (182)	86.8% (165)
Canoe/Kayak Combined	73.8% (816)	76.6% (614)	79.6% (195)	82.2% (112)	85.7% (255)	80.0% (244)	76.0% (234)	75.1% (266)	88.8% (167)	74.6% (274)	77.2% (263)	83.3% (214)	85.6% (224)	78.3% (255)	92.0% (284)	81.0% (233)	82.7% (225)	82.2% (231)
Paddleboards (SUPs)	.	.	.	.	.	. (3)	. (1)	. (9)	. (5)	. (13)	51.9% (52)	75.0% (44)	77.5% (40)	73.4% (84)	75.0% (80)	77.1% (61)	64.3% (98)	78.7% (75)
All Paddlecraft** (including SUPs)	.	.	.	.	.	67.3% (490)	70.5% (320)	63.5% (428)	84.1% (236)	67.3% (489)	63.8% (423)	78.3% (381)	85.2% (380)	84.6% (473)	90.3% (494)	79.6% (388)	82.3% (401)	94.6% (605)

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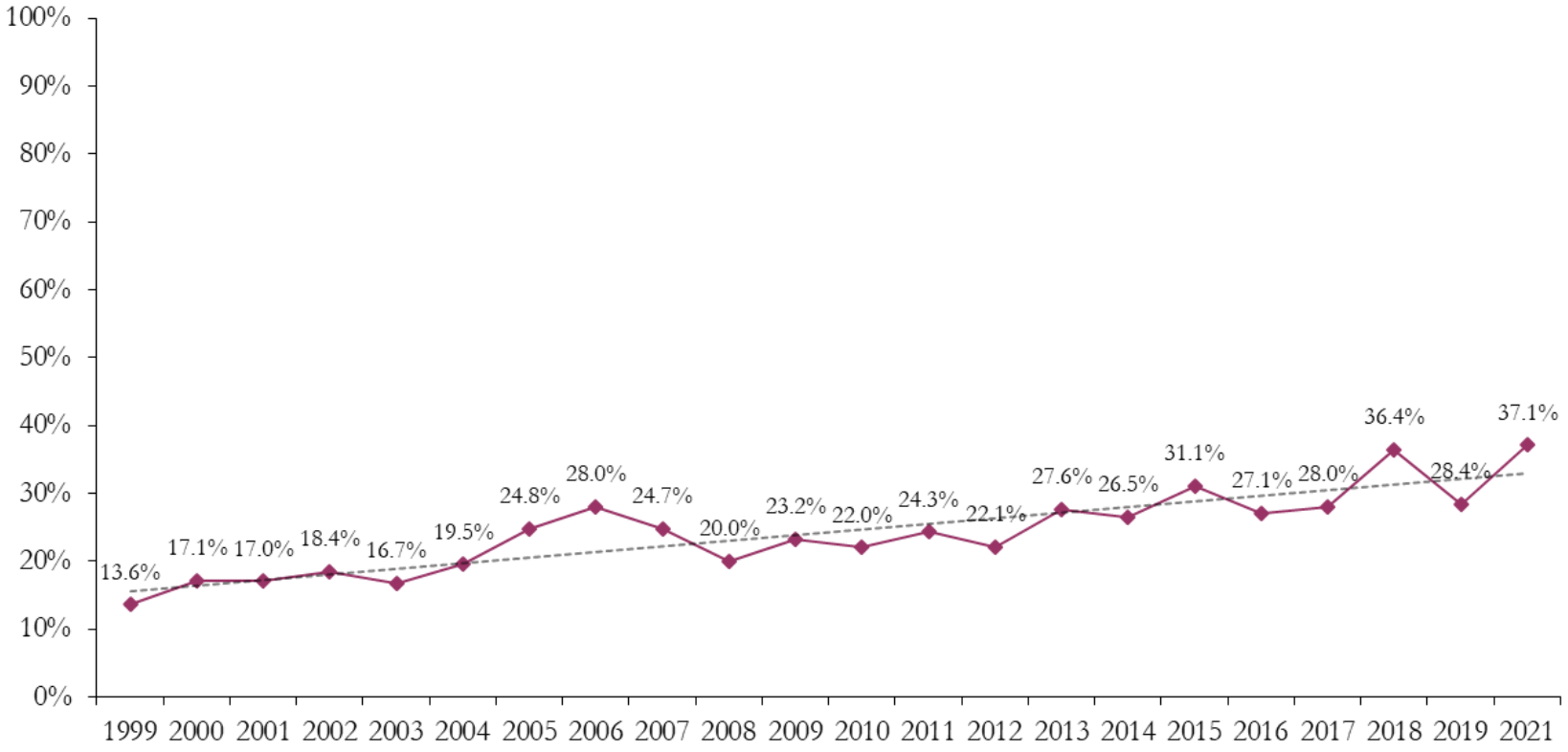
*Factors controlled for: Age & Boat Type.
**Data for this line in the table have been corrected on 5-21-2015 from the earlier published version.

Sailboats for Adults (18 years or older)

Figure I and Table 2.6 document observations of adults in sailboats. For all sailboats combined, the wear rate of 37.1% represents a 173% relative increase since 1999 (13.6%). Sailboat wear rates for both day sailors and cabin sailboats have increased over the twenty-two years of observations. Day sailors have shown a relative increase of 161% from 1999 to 2021 (34.6% to 80.1%) which is the highest rate ever observed. Cabin sailboats have shown a relative increase of 192% from 1999 to 2021 (10.2% to 26.6%).

Figure I – Adult Wear Rates for ALL Sailboats*



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*Factors controlled for: Age & Boat Type.

Table 2.6 – Life Jacket Wear Rates by Sailboats for Adults*

Boat Type	Observation Year																	
	1999-2001 % (N's)	2002-2004 % (N's)	2005 % (N's)	2006 % (N's)	2007 % (N's)	2008 % (N's)	2009 % (N's)	2010 % (N's)	2011 % (N's)	2012 % (N's)	2013 % (N's)	2014 % (N's)	2015 % (N's)	2016 % (N's)	2017 % (N's)	2018 % (N's)	2019 % (N's)	2021 % (N's)
All Sailboats	16.0% (10828)	18.3% (11385)	24.8% (3084)	28.0% (3279)	24.7% (3217)	20.0% (3079)	23.2% (3733)	22.0% (3336)	24.3% (3231)	22.1% (3297)	27.6% (2840)	26.5% (2786)	31.1% (2800)	27.1% (2557)	28.0% (2269)	36.4% (2766)	28.4% (2568)	37.1% (1742)
Sailboard	52.6% (91)	89.4% (122)	53.0% (20)	. (12)	83.7% (18)	94.6% (17)	. (7)	83.2% (29)	. (9)	. (14)	. (10)	. (3)	94.5% (17)	. (10)	. (10)	92.0% (36)	82.0% (28)	92.8% (13)
Day Sailor	34.6% (2134)	45.4% (2923)	56.4% (736)	59.1% (607)	50.4% (397)	48.3% (649)	61.7% (652)	57.5% (731)	61.3% (736)	54.0% (682)	67.1% (469)	55.1% (630)	69.6% (565)	62.4% (532)	61.9% (365)	70.4% (560)	72.6% (602)	80.1% (249)
Cabin Sailboat	10.2% (8603)	9.9% (8340)	15.4% (2328)	19.1% (2660)	17.1% (2802)	12.0% (2413)	13.0% (3074)	11.7% (2576)	13.4% (2486)	12.9% (2601)	17.3% (2361)	18.3% (2153)	20.5% (2218)	17.2% (2015)	18.8% (1894)	27.1% (2170)	15.7% (1938)	26.6% (1480)

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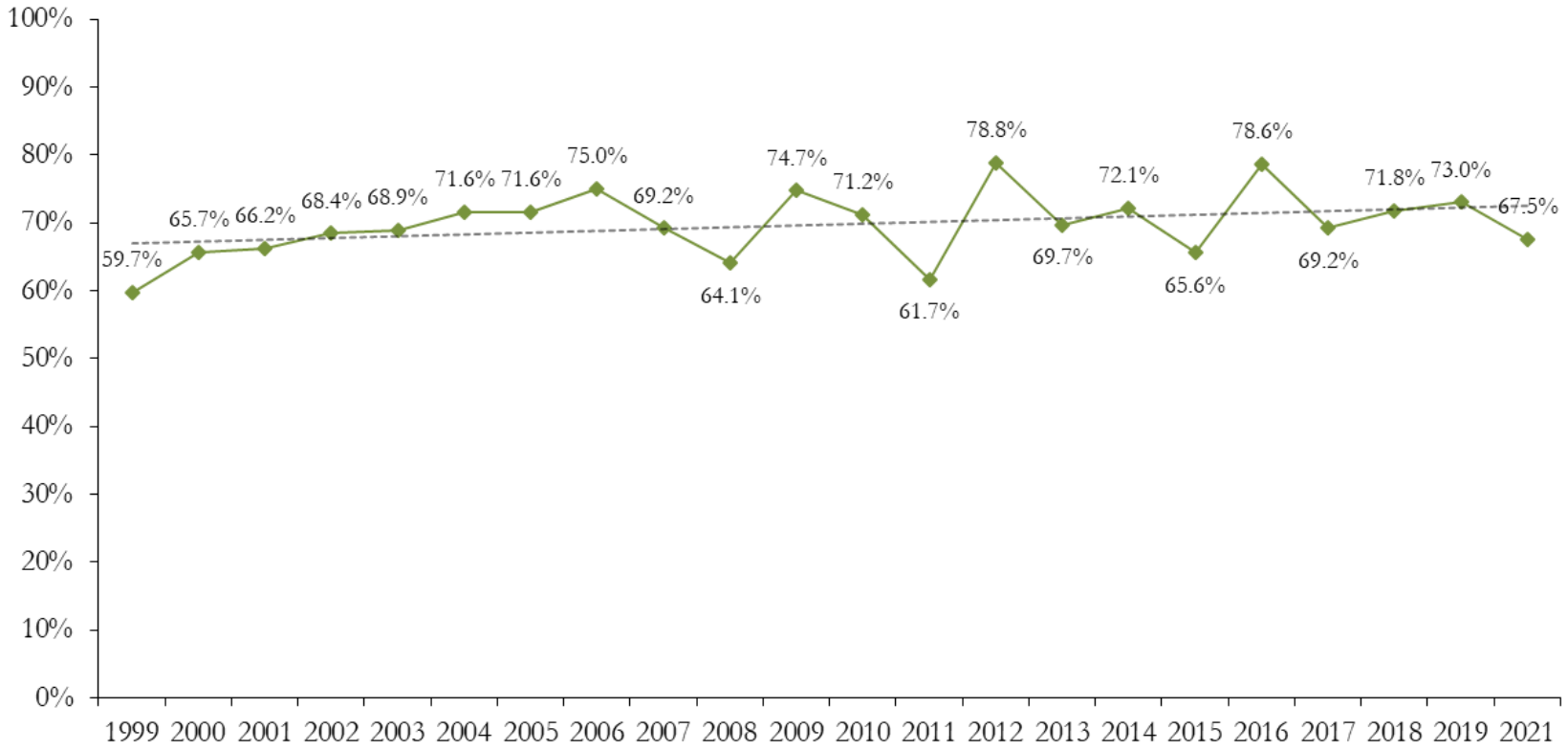
*Factors controlled for: Age & Boat Type.

Sailboats for Youth (17 years or younger)

Figure J and Table 2.7 show that the national average wear rate on all sailboats for all youth in 2021 was 67.5% and represents a relative increase of 13% since 1999 (59.7%). View wear rates with caution since relatively few youth, particularly younger youth, participate on these types of boats.

Figure J – Youth Wear Rates for ALL Sailboats*



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*Factors controlled for: Age & Boat Type.

Table 2.7 – Life Jacket Wear Rates by Sailboats for Youth*

Boat Type	Observation Year																	
	1999-2001 % (N's)	2002-2004 % (N's)	2005 % (N's)	2006 % (N's)	2007 % (N's)	2008 % (N's)	2009 % (N's)	2010 % (N's)	2011 % (N's)	2012 % (N's)	2013 % (N's)	2014 % (N's)	2015 % (N's)	2016 % (N's)	2017 % (N's)	2018 % (N's)	2019 % (N's)	2021 % (N's)
All Sailboats	64.0% (1100)	69.6% (1027)	71.6% (327)	75.0% (371)	69.2% (270)	64.1% (274)	74.7% (305)	71.2% (202)	61.7% (219)	78.8% (313)	69.7% (220)	72.1% (206)	65.6% (170)	78.6% (200)	69.2% (147)	71.8% (174)	73.0% (211)	67.5% (64)
Sailboard	68.8% (16)	90.8% (52)	. (1)	. (4)	. (8)	. (0)	. (0)	. (1)	. (0)	. (1)	. (0)	. (1)	. (0)	. (1)	. (0)	. (1)	. (3)	. (1)
Day Sailor	80.5% (280)	84.4% (303)	73.4% (67)	93.2% (122)	86.5% (54)	88.0% (75)	92.5% (80)	85.2% (86)	80.2% (57)	98.2% (166)	91.5% (36)	97.2% (54)	87.7% (27)	96.4% (103)	90.7% (25)	95.2% (39)	96.7% (70)	85.7% (11)
Cabin Sailboat	59.2% (804)	63.9% (672)	69.4% (259)	65.7% (245)	62.4% (208)	56.4% (196)	66.4% (225)	65.9% (115)	54.9% (162)	60.3% (146)	61.7% (184)	61.0% (152)	58.6% (143)	66.7% (97)	66.2% (122)	61.5% (134)	60.3% (138)	61.6% (52)

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*Factors controlled for: Age & Boat Type.

Boat Type and Size for Adults (18 years or older)

Table 2.8 shows the breakdown of adult wear rates by boat size for three general categories of boat types: powerboats, sailboats, and paddlecraft. Data are presented only for 2004 to 2021, since 2004 was the first year that observations were divided into two size categories of 16 to 21 feet and 21 to 26 feet, from one category (16 to 26 feet that was used in prior years.)

Wear rates and boat size show an inverse relationship: wear rates decrease as the size of the boat increases. This is true for all three general types of boats. In 2021, for powerboats under 16 feet in length wear rates are at 16.5% but dropped steadily to 2.1% for boats over 26 feet in length. In 2021, for sailboats under 16 feet in length wear rates are 70.3% but dropped to 14.7% for those over 26 feet in length. In 2021, for paddlecraft under 16 feet in length wear rates are 66.4% whereas for paddlecraft greater than 16 feet wear rates are 30.1%. Part of the explanation for this drop is the marked change in the proportions of different types of paddle craft in the two size groups. There are many more kayaks with high wear rates in the under 16 foot category. When comparing wear rates for each size category to rates seen in 2004 almost every length within the general boat types show marked increases over those 16 years of the study. However, because there is also a trend during that period to a greater proportion of boaters using bigger boats (with their lower wear rates), the relative increases of wear rates for all sizes combined are less than observed for the individual size categories within the general boat types.

Table 2.8 – Life Jacket Wear Rates by Boat Type and Size for Adults*
2004 to 2021

Boat Type and Size	Observation Year																	
	2004 % (N's)	2005 % (N's)	2006 % (N's)	2007 % (N's)	2008 % (N's)	2009 % (N's)	2010 % (N's)	2011 % (N's)	2012 % (N's)	2013 % (N's)	2014 % (N's)	2015 % (N's)	2016 % (N's)	2017 % (N's)	2018 % (N's)	2019 % (N's)	2021 % (N's)	Total % (N's)
Powerboats (no PWCs)																		
<16 ft.	8.2% (2320)	7.6% (2734)	7.1% (3395)	8.7% (2173)	7.6% (1862)	8.5% (1824)	11.5% (2764)	8.4% (2183)	9.3% (1599)	9.3% (2119)	12.4% (2951)	6.6% (2174)	6.5% (2008)	9.4% (1483)	13.0% (1691)	13.7% (2086)	16.5% (1623)	7.7% (36377)
16-20.9 ft.	4.7% (16298)	5.1% (14629)	4.4% (11778)	4.9% (13034)	6.1% (12586)	5.0% (13125)	5.0% (13944)	5.2% (13255)	5.1% (12898)	4.3% (11424)	7.2% (12217)	6.9% (11763)	6.3% (11340)	8.3% (11416)	7.8% (11696)	5.9% (12441)	6.0% (8322)	45.3% (212113)
21-25.9 ft.	2.4% (6218)	3.2% (5503)	2.4% (6957)	3.7% (8634)	3.4% (9127)	2.3% (10420)	2.4% (9713)	2.0% (8718)	2.7% (9389)	2.5% (9364)	3.4% (9533)	4.2% (8270)	2.2% (9048)	4.2% (8467)	3.0% (11050)	4.7% (10115)	3.2% (9957)	32.2% (150483)
26+ ft.	0.8% (3407)	1.4% (2865)	1.6% (3268)	1.5% (3782)	1.5% (3650)	1.8% (4546)	1.3% (4473)	1.3% (4798)	2.0% (4004)	2.1% (3874)	1.4% (4065)	2.5% (4234)	1.8% (4393)	3.5% (4442)	1.7% (5153)	1.8% (4144)	2.1% (3659)	14.8% (69029)
Sailboats																		
<16 ft.	75.0% (481)	74.0% (376)	79.7% (265)	67.6% (77)	73.2% (163)	70.2% (247)	65.5% (299)	74.6% (160)	74.2% (194)	78.7% (136)	70.3% (265)	89.6% (200)	89.0% (197)	81.5% (136)	70.5% (198)	77.0% (328)	70.3% (75)	62.7% (3797)
16-20.9 ft.	34.2% (357)	41.9% (312)	57.7% (609)	51.8% (193)	46.8% (370)	58.0% (157)	57.4% (346)	63.8% (390)	48.6% (379)	66.3% (314)	43.6% (248)	63.1% (225)	47.8% (339)	51.3% (239)	70.4% (398)	65.2% (317)	74.9% (357)	45.1% (5586)
21-25.9 ft.	12.2% (1428)	24.1% (1527)	21.0% (793)	25.5% (797)	14.0% (911)	21.5% (949)	16.7% (766)	27.5% (846)	24.3% (989)	27.6% (736)	23.8% (593)	41.1% (654)	29.4% (559)	39.1% (541)	37.9% (685)	30.1% (728)	43.8% (462)	26.8% (13964)
26+ ft.	9.9% (1864)	3.2% (875)	11.5% (1614)	15.2% (2148)	11.6% (1629)	13.1% (2380)	11.0% (1925)	9.6% (1835)	8.3% (1735)	13.4% (1654)	17.7% (1644)	15.1% (1721)	13.3% (1453)	11.6% (1353)	23.1% (1485)	8.4% (1192)	14.7% (848)	15.5% (27355)
Paddlecraft (excluding SUPs)																		
<16 ft.	60.4% (1056)	68.4% (1012)	70.6% (1147)	44.8% (1306)	38.2% (1319)	42.7% (1296)	38.0% (1953)	42.6% (1021)	57.2% (1647)	43.0% (1532)	55.3% (1760)	52.5% (2126)	49.8% (2079)	61.9% (1694)	64.1% (1671)	67.0% (1722)	66.4% (1284)	73.3% (24414)
16-20.9 ft.	49.4% (531)	11.1% (488)	53.0% (171)	35.7% (672)	67.9% (180)	64.4% (347)	42.0% (331)	53.2% (587)	47.3% (367)	56.2% (383)	32.2% (795)	44.0% (395)	38.2% (312)	41.3% (541)	36.6% (674)	33.0% (343)	30.1% (783)	23.5% (7825)

JSI Research & Training Institute, Inc.
2021 National Observational Life Jacket Wear Rate Study
*Factors controlled for: Age & Boat Type.

III. Engine Cut-off Switch

Engine cut-off switches (ECOS) are US Coast Guard-required equipment on recreational powerboats less than 26 feet since December 2019. Even before this regulation took effect, manufacturers started to fit recreational powerboats of this size with ECOS links to help prevent runaway vessels when the operator goes overboard. In addition to boats of this size category being fitted with this equipment, a new federal law effective April 1, 2021, required those operating powerboats under 26 feet to use an ECOS while under way. This law only applies when the helm is not in a cabin and when the boat is operating on plane or above displacement speed. Use of the ECOS link is not required while the boat is docking, launching, loading on a trailer, trolling and operating in no-wake zones.

In 2021 JSI expanded data collection to include observations of the use of ECOS on powerboats. ECOS status was collected for all powerboats regardless of size and boating activity. Table 2.9 and Table 2.10 show results of the initial year of ECOS observations. Table 2.9 shows the proportion of observations for each boat type where the observer was able or not able to determine if the operator was using ECOS equipment. This may happen in situations when the view of the operator is partially obstructed, the boat is too far away, or moving at a speed that limits the detail the observer is able to obtain. Table 2.10 shows observations when use or non-use was visible and could be recorded by the observers.

Table 2.9 shows the difficulty in capturing ECOS use during observations as an ECOS is usually attached to the operator's wrist, belt, or life jacket, a view often obstructed by the vessel itself. Distance from the vessel can also prevent an observer from making a clear ECOS observation. As can be seen, visibility decreases as length increases. Visibility was only possible in about 50% of skiffs; about a third of speedboats, and about half of pontoon boats or powered inflatables. ECOS for PWCs was visible in only about 90%. As shown in Table 2.10, ECOS use clearly observed (yes), the majority of operators were not using an ECOS with the exception of PWC operators using an ECOS at a rate of 87.1% where ECOS use is often required. Other powerboat types showed ECOS use of 10% or less. Data should viewed with caution due to the difficulty in clearly observing this data point.

Table 2.9 – 2021 ECOS Use Visibility (Yes) by Boat Type and Size

(Data are for boats not boaters; n's are denominators)

Boat Type	Boat Size			
	<16 ft. % (N's)	16 to <21 ft. % (N's)	21 to <26 ft. % (N's)	TOTAL % (N's)
Skiff/Utility	48.9% (519)	48.7% (1488)	42.1% (953)	46.6% (2960)
Runabout/ Speedboat	35.2% (108)	23.8% (1516)	20.4% (1244)	22.8% (2868)
Cabin Cruiser	0.0% (0)	32.2% (87)	19.9% (316)	22.6% (403)
Houseboat	0.0% (0)	0.0% (0)	33.3% (3)	33.3% (3)
Pontoon	45.5% (11)	42.5% (233)	35.1% (775)	36.9% (1019)
Powered Inflatable/Raft	54.3% (129)	57.1% (14)	0.0% (2)	53.8% (145)
PWC	87.1% (1334)	0.0% (0)	0.0% (0)	87.1% (1334)
All Power Boats	72.8% (2101)	36.6% (3338)	30.1% (3293)	42.8% (8732)

Table 2.10 – 2021 Observed ECOS Use Rates by Boat Type and Size

(Data are for boats not boaters; n's are denominators)

Boat Type	Boat Size			
	<16 ft. % (N's)	16 to <21 ft. % (N's)	21 to <26 ft. % (N's)	TOTAL % (N's)
Skiff/Utility	2.8% (254)	5.7% (725)	5.2% (401)	5.0% (1380)
Runabout/ Speedboat	2.6% (38)	9.7% (361)	12.6% (254)	10.4% (653)
Cabin Cruiser	0.0% (0)	3.6% (28)	0.0% (63)	1.1% (91)
Houseboat	0.0% (0)	0.0% (0)	0.0% (1)	0.0% (1)
Pontoon	0.0% (5)	8.1% (99)	8.1% (272)	8.0% (376)
Powered Inflatable/Raft	7.1% (70)	12.5% (8)	0.0% (0)	7.7% (78)
PWC	90.5% (1162)	0.0% (0)	0.0% (0)	90.5% (1162)
All Power Boats	65.6% (1529)	7.0% (1221)	7.6% (991)	32.8% (3741)

IV. Information on Boats & People Observed

From 1999 to 2021, JSI has observed a total of 314,664 boats and 884,967 boaters (Figure N). This year, 2021, 12,709 boats carrying 34,189 boaters were observed. The proportions of the different types of boats, length of boat, operation and activity of boats, as well as the age and gender of the boaters observed has remained fairly consistent (see Figures O through V2). This indicates not only that the sites chosen yielded diversity in the boats and boaters observed each year, but also that diversity has remained relatively consistent across the years. These figures demonstrate that the degree of representativeness of the sample of recreational boaters and their boating habits remained relatively constant across this twenty-one year span.

Figures W through AC illustrate the weather and water conditions across the sites from year to year. Like the boat and boater data, across all of the sites, the mixture of the weather and water conditions remained fairly constant over the years. Therefore, any overall changes reported in life jacket wear rates were not due to changes in types of boats or boaters observed from year to year, and most likely not due to fluctuations in weather or water conditions across the sites. Of course, at individual site locations changes in these factors from year to year could account for sizable fluctuations in wear rates at individual sites.

All figures in this section have been modified slightly from reports prior to 2011. The percentages now exclude (like the 2011 report) any missing observations on a particular characteristic. Since missing observations are relatively rare, this switch in presentation does not result in any major shifts in proportions shown in previous reports (before 2011).

V. Conclusions for Life Jacket Wear Rates

For the twenty-two years of the life jacket national observation study there have been increases in wear rates on all types of boats and for all age groups. The average wear rate in 2021 for all boaters on all types of boats except PWCs was 19.5%, which is a relative increase of 27% over the 1999 wear rate of 15.4%.

Some boat types show greater increases than other boat types. The same is true for age groups. Below JSI summarizes the relative increases in wear rates for age groups and for boat types.

1. For many different age groups of boaters on all types of boats taken together, wear rates in 2021 mark substantial relative increases in wear rates since the 1999 baseline year.

    a. All adults (18+) on all types of boats excluding PWCs: 17% relative increase (9.0% to 10.5%)
    b. All youth (0-17) on all types of boats excluding PWCs: 35% relative increase (52.1% to 70.4%)
    c. Children (0-5) on all types of boats excluding PWCs: 13% relative increase (80.6% to 91.3%)
    d. Children (6-12) on all types of boats excluding PWCs: 28% relative increase (69.1% to 88.6%)
    e. Teenagers (13-17) on all types of boats excluding PWCs: 69% relative increase (24.1% to 40.7%)

2. For adults there have been notable relative increases in wear rates by specific types of boats comparing 2021 levels to the baseline year of 1999.

    a. All powerboats except PWCs: 16% relative increase (4.4% to 5.1%)
    b. Open motorboats: 42% relative increase from 2006 (4.5% to 6.4%)
    c. All paddlecraft except paddleboards: 13% relative increase (46.2% to 53.2%)
    d. All sailboats: 173% relative increase (13.6% to 37.1%)
    e. Day sailors: 161% increase (30.7% to 80.1%)
    f. Cabin sailboats: 192% increase (9.1% to 26.6%)

3. Over the twenty-three-year span of this study, there has been a trend for a larger proportion of the boating public to use longer boats. This is particularly true for the powerboat category. In 2004, about a third of the occupants (34%) were on powerboats less than 21 feet in length, but in 2021, 58% of the boating public were on powerboats of greater than 21 feet. However, since wear rates tend to be lower on larger boats, this trend of increasing boat sizes, masks the actual relative proportion of increases of wear rates observed if one only looked at improvements within a boat size category. Data are shown for adults starting in 2004 since that was the first year observations were made dividing the 16 to 25 feet category into 16 to 21 feet and 21 to 26 feet in lengths.

    a. Relative increase for all powerboats from 2004 to 2021 is 31% (3.9% to 5.1%)
    b. For powerboats under 16 feet in length, the relative increase is 94% (8.5% to 16.5%)
    c. For powerboats from 16 to 21 feet in length, the relative increase is 28% (4.7% to 6.0%)
    d. For powerboats from 21 to 26 feet in length, the relative increase is 33% (2.4% to 3.2%)
    e. For powerboats greater than 26 feet in length, the relative increase is 163% (0.8% to 2.1%)

V1. Appendix A: Methods & Descriptive Information

To provide reliable and valid indicators of changes in life jacket wear rates, it was essential for observation procedures to remain as close as possible to those used in previous years. The same states were observed for each of the years of data collection efforts, during the same period of time (July and August). The vast majority of the sites in each of 30 states observed have remained the same for all years. The following is a detailing of the methods used in all years of data collection.

Time period - Observations were conducted during the summer months of each year, beginning the weekend of July 4th and ending on Labor Day weekend.

Site selection - A total of 30 states were chosen in which to conduct observations. The states were originally selected by a stratified random sampling procedure. Approximately three-fourths of the coastal states (20 out of 26 states) were chosen, and approximately 40% of the inland states (10 out of 24) were selected. Four sites from each state were visited, except in California, where eight sites were observed due to the size of the state. The 124 sites represented a wide range of water venues including lakes, rivers, harbors and bays, and intra-coastal waterways. The sites were selected based on consultations with local offices of the USCG, members of the local Coast Guard Auxiliary or U.S. Power Squadrons, and state boating or fishing law enforcement agencies. Sites were selected to roughly represent a variety of available boating venues in the state, as well as their proximity to one another to allow for relatively short travel time between sites. In addition, sites needed to have suitable shore-based viewing locations from which observations of life jacket wear could be made using high-powered binoculars.

Observational procedures - Observations were conducted by JSI or USCGAUX staff for four-hour periods in the morning or the afternoon of a Saturday or Sunday. The goal was to observe as many boats as possible during a four-hour time frame. Viewing locations were on shore at a narrowing, bridge, or near a marina to facilitate observations. Two-person teams observed boating activity. One team member made the observations using high-powered, image-stabilizing binoculars and called out the information, recorded on observation forms by the second team member. Team members alternated responsibilities frequently to ward off fatigue. In addition to recording information on boating activity and life jacket wear, observers recorded data about the site. This included information on weather and water conditions. JSI project staff trained JSI and USCGAUX observers via web instruction and an on-line quiz. The training curriculum covered procedures, definitions, and pictures of various types of boats and passengers to facilitate consistent classification by observers. The e-learning web course also explained how to complete the data collection forms, including new data points, and use project equipment to take weather observations.

Observation Forms - There were two observation forms designed. The first was the boat observation form, which was intended to record information about the boat and people on the boat. The second form was the site form, which was designed to record information about the site, weather and water conditions. The forms have remained the same from year to year, with the exception of two changes made in 1999, one change made in 2004, one change made in 2007, three changes made in 2016, and one change made in 2021. These changes are discussed in detail below.

A) Boat Forms - Observers recorded the observation **time period** in two hour blocks of time (7:59 or earlier, 8am – 9:59am, 10am – 11:59pm, 12pm – 1:59pm, 2pm – 3:59pm, 4pm – 5:59pm, 6pm or later); the **type of boat** observed (skiff, speedboat/runabout, cabin cruiser, personal watercraft (PWC), pontoon boat, houseboat, sailboard, day sailor, cabin sailboat, rowboat, inflatable, canoe, kayak, and

other); **ECOS status** (Y, N, ? (unsure)); **length of boat** (less than 16 feet, 16-20.9 feet, 21-25.9 feet, 26-45.9, and 46+ feet); **type of operation** (motoring, sailing, paddling, drifting, or at anchor); and **activity** engaged in (fishing, intent to fish, water-skiing, white-water, high speed racing, swimming, pleasure boating, and other). Observers also recorded **operator/passenger status**; **gender** (male, female, or unknown); **age** (less than six, 6 - 12, 13 - 17, 18 - 64, 65 or older); **life jacket wear** and **life jacket type** (buoyant/traditional, inflatable suspender or belt pack, or not wearing). In addition, if the boat was involved in water-skiing or a towing sport, observers indicated which **boaters were skiing** (or being towed) at the time.

B) Site Forms - At each site, the observers recorded the beginning time and ending **time of the observation period**, **water type** (lake, river, harbor/bay, Great Lake, intra-coastal waterway), and **water temperature**. The following environmental factors were measured by observers at each two hour time block during the observation period: **air temperature**; **wind speed**; **wave height** (less than six inches, six inches up to two feet, or over two feet); **weather** (sunny, partly cloudy, cloudy, raining, or stormy); and **visibility** (good, fair, or poor).

Over the past 21 years of observations five categories of information have changed. In 1999, the original 6 to 17 year old age category was divided into a 6 to 12 year old group and a 13 to 17 year old group. Also in 1999, the boat category of canoes/kayaks was separated to record canoes and kayaks individually. In 2004 the USCG requested that JSI breakout the boat size categories from three (less than 16 feet, 16-25 feet and over 26 feet) to four categories (less than 16 feet, 16-20 feet, 21-25 feet and over 26 feet). Observations made in 2004 to 2011 are the only years to record observations using the expanded boat size categories. In 2007, JSI added an "intent to fish" category distinct from "pleasure". Intent to fish was indicated when a boat could be observed with obvious fishing gear (fishing rods, trolling motors, etc.) even though at the moment of observation, the boaters were not fishing. In 2016 JSI removed the type of propulsion category from the form because it was not adding value to our analysis. Instead JSI added separate boat type categories for "powered" inflatables and "paddled" inflatable the only ambiguous category. Finally, JSI updated the life jacket wear and type categories for the first time. Until 2016, options read "Old," meaning inherently buoyant, "New," meaning inflatable and "No," for not wearing. In order to prevent confusion about these categories, they were renamed more explicitly to "Buoyant (Trad)," "Inflatable" "Susp" (suspender) and "Belt," and "Not Wear."

JSI Data Collection Form: 2021 Boat Form

TIME: ○ 7:59 or earlier ○ 8:00 - 9:59 am ○ 10:00 - 11:59 am ○ 12:00 - 1:59 pm ○ 2:00 - 3:59 pm ○ 4:00 - 5:59 pm ○ 6:00 or later

61771

POWER BOAT: ○ Skiff/Utility ○ Pontoon ○ Runabout ○ Inflatable/Raft ○ Cabin cruiser ○ Houseboat ○ PWC **ECOS** ○ Y ○ N ○ ?

SAIL: ○ Day sailor ○ Cabin sailboat ○ Sailboard

PADDLE: ○ Kayak ○ Paddle board ○ Canoe ○ Inflatable ○ Rowboat

SIZE: ○ Under 16 ○ 16 - 20.9 ○ 21 - 25.9 ○ 26 - 45.9 ○ 46 +

OPERATION: ○ Cruising/Motoring ○ Sailing ○ Rowing/Paddling ○ Drifting ○ Anchored

ACTIVITY: ○ Pleasure ○ Fishing ○ Water skiing ○ Intent to Fish ○ White water ○ Swimming ○ High Speed ○ Other

	GENDER			AGE(years)					PFD				WS SW
	M	F	?	0-5	6-12	13-17	18-64	65+	Buoyant (Trad)	Inflatable Susp	Inflatable Belt	Not Wear	Yes
OP	○	○	○	○	○	○	○	○	○	○	○	○	
P1	○	○	○	○	○	○	○	○	○	○	○	○	○
P2	○	○	○	○	○	○	○	○	○	○	○	○	○
P3	○	○	○	○	○	○	○	○	○	○	○	○	○
P4	○	○	○	○	○	○	○	○	○	○	○	○	○
P5	○	○	○	○	○	○	○	○	○	○	○	○	○
P6	○	○	○	○	○	○	○	○	○	○	○	○	○
P7	○	○	○	○	○	○	○	○	○	○	○	○	○
P8	○	○	○	○	○	○	○	○	○	○	○	○	○

POWER BOAT: ○ Skiff/Utility ○ Pontoon ○ Runabout ○ Inflatable/Raft ○ Cabin cruiser ○ Houseboat ○ PWC **ECOS** ○ Y ○ N ○ ?

SAIL: ○ Day sailor ○ Cabin sailboat ○ Sailboard

PADDLE: ○ Kayak ○ Paddle board ○ Canoe ○ Inflatable ○ Rowboat

SIZE: ○ Under 16 ○ 16 - 20.9 ○ 21 - 25.9 ○ 26 - 45.9 ○ 46 +

OPERATION: ○ Cruising/Motoring ○ Sailing ○ Rowing/Paddling ○ Drifting ○ Anchored

ACTIVITY: ○ Pleasure ○ Fishing ○ Water skiing ○ Intent to Fish ○ White water ○ Swimming ○ High Speed ○ Other

	GENDER			AGE(years)					PFD				WS SW
	M	F	?	0-5	6-12	13-17	18-64	65+	Buoyant (Trad)	Inflatable Susp	Inflatable Belt	Not Wear	Yes
OP	○	○	○	○	○	○	○	○	○	○	○	○	
P1	○	○	○	○	○	○	○	○	○	○	○	○	○
P2	○	○	○	○	○	○	○	○	○	○	○	○	○
P3	○	○	○	○	○	○	○	○	○	○	○	○	○
P4	○	○	○	○	○	○	○	○	○	○	○	○	○
P5	○	○	○	○	○	○	○	○	○	○	○	○	○
P6	○	○	○	○	○	○	○	○	○	○	○	○	○
P7	○	○	○	○	○	○	○	○	○	○	○	○	○
P8	○	○	○	○	○	○	○	○	○	○	○	○	○

POWER BOAT: ○ Skiff/Utility ○ Pontoon ○ Runabout ○ Inflatable/Raft ○ Cabin cruiser ○ Houseboat ○ PWC **ECOS** ○ Y ○ N ○ ?

SAIL: ○ Day sailor ○ Cabin sailboat ○ Sailboard

PADDLE: ○ Kayak ○ Paddle board ○ Canoe ○ Inflatable ○ Rowboat

SIZE: ○ Under 16 ○ 16 - 20.9 ○ 21 - 25.9 ○ 26 - 45.9 ○ 46 +

OPERATION: ○ Cruising/Motoring ○ Sailing ○ Rowing/Paddling ○ Drifting ○ Anchored

ACTIVITY: ○ Pleasure ○ Fishing ○ Water skiing ○ Intent to Fish ○ White water ○ Swimming ○ High Speed ○ Other

	GENDER			AGE(years)					PFD				WS SW
	M	F	?	0-5	6-12	13-17	18-64	65+	Buoyant (Trad)	Inflatable Susp	Inflatable Belt	Not Wear	Yes
OP	○	○	○	○	○	○	○	○	○	○	○	○	
P1	○	○	○	○	○	○	○	○	○	○	○	○	○
P2	○	○	○	○	○	○	○	○	○	○	○	○	○
P3	○	○	○	○	○	○	○	○	○	○	○	○	○
P4	○	○	○	○	○	○	○	○	○	○	○	○	○
P5	○	○	○	○	○	○	○	○	○	○	○	○	○
P6	○	○	○	○	○	○	○	○	○	○	○	○	○
P7	○	○	○	○	○	○	○	○	○	○	○	○	○
P8	○	○	○	○	○	○	○	○	○	○	○	○	○

PFD Study 2021

CODE State Site Block Group Phase Page Number

JSI Data Collection Form: 2021 Site Form

PFD Study 2021

# of Boats Observed | **ID** State | Site | Block | Group | Phase

1. Site Information

Observer Names: _____ City: _____

Site Name: _____ Water: _____

Date of Observation: ☐☐ / ☐☐ / ☐☐ Day of the week: ○ Sat. ○ Sun.

Observation start time: ☐☐ : ☐☐ ○ AM ○ PM Observation end time: ☐☐ : ☐☐ ○ AM ○ PM

★★ **Loaner Board**: ○ **Yes (COMPLETE 'Loaner Board' section on back of page.)** ○ **No**

2. Type of Body of Water

○ Bay, inlet or sound ○ River, stream, creek or canal ○ Other: _____

○ Harbor ○ Lake, pond, or reservoir (not Great Lakes)

○ Intracoastal waterway ○ Great lake (not including tributaries)

3. Site Conditions

Water temperature: ☐☐ degrees F

A. First Weather Observation (to be completed during 1st time block of boat observations)

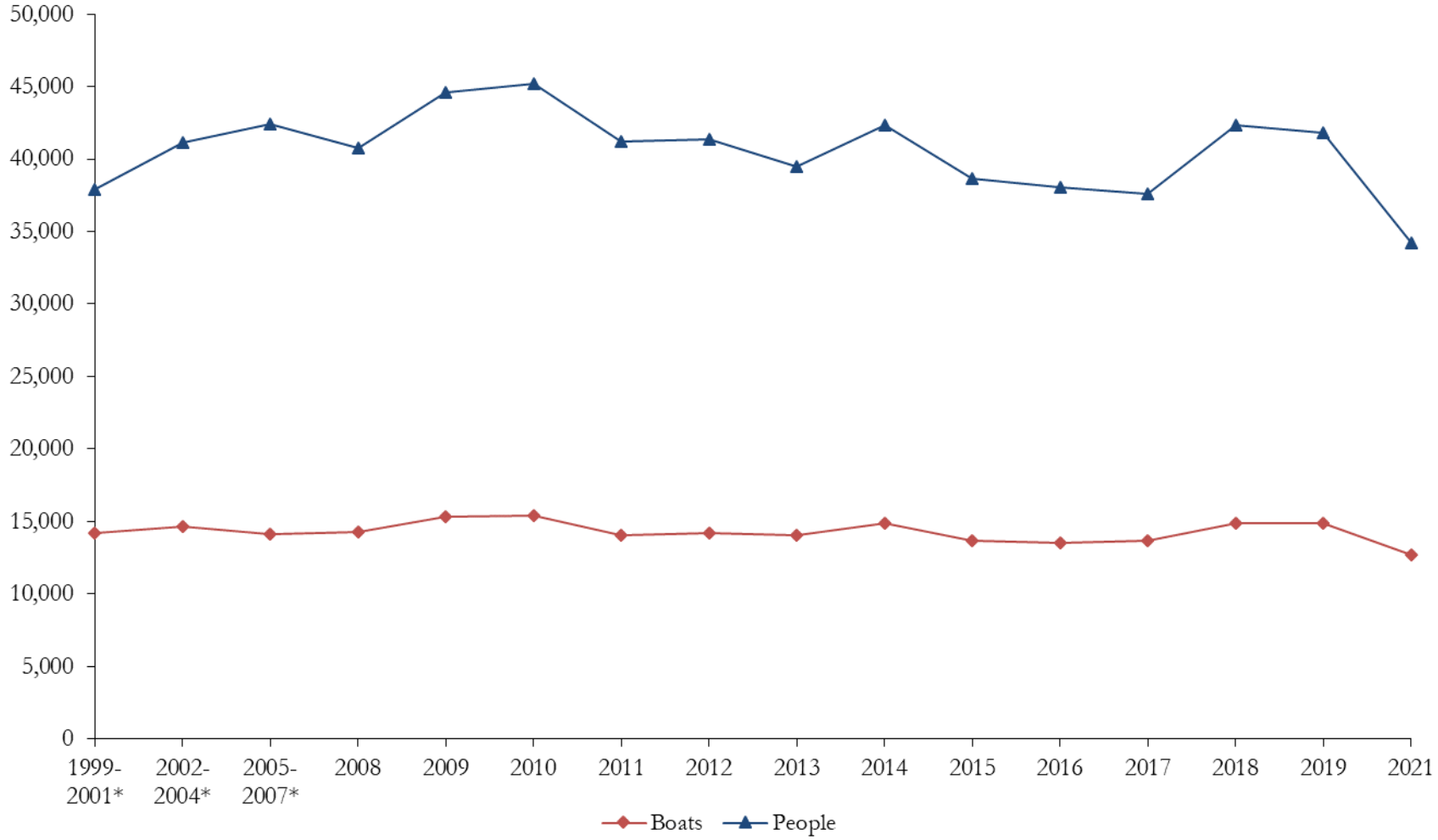
Time:

○ 7:59 or before ○ 8-9:59 AM ○ 10-11:59 AM ○ 12-1:59 PM ○ 2-3:59 PM ○ 4-5:59 PM ○ 6 PM or later

Air Temp. ☐☐☐ F	**Water Conditions**	**Current**	**Visibility**	**Weather Conditions**
Wind Speed ☐☐ knots	○ Calm (less than 6")	○ Strong	○ Good	○ Sunny ○ Raining
	○ Choppy (6" to 2')	○ Moderate	○ Fair	○ Partly Cloudy ○ Stormy
	○ Rough (over 2')	○ Weak/None	○ Poor	○ Cloudy

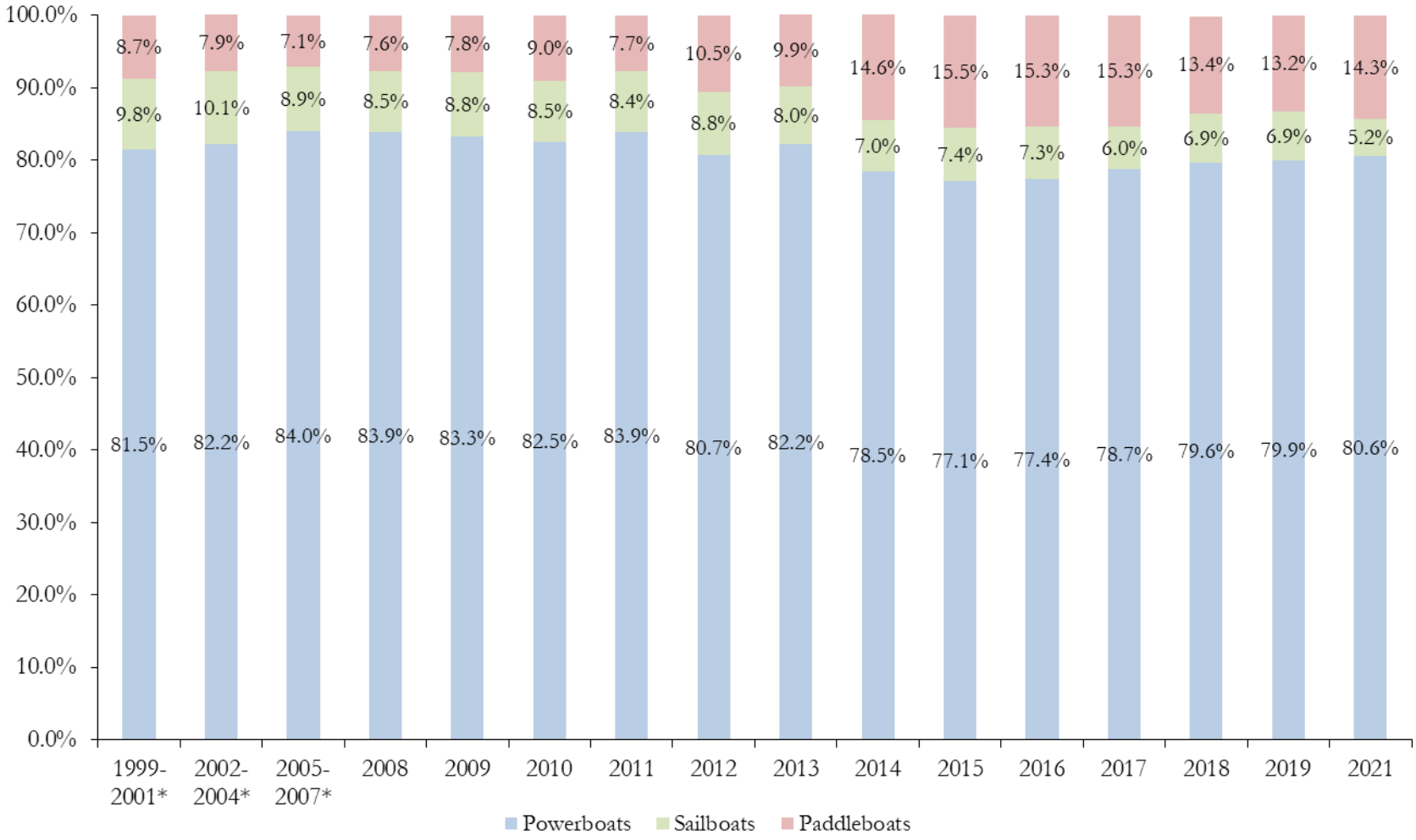
*Actual form provides 3 blocks to record Weather Observations across the 4 hours of data collection

Figure O – Number of Boats and People



*Three-year average

Figure P – Types of Boats



*Three-year average

Figure Q – Length of Boats

*Three-year average

Figure R – Length of Boats 2005-2021 Data Only

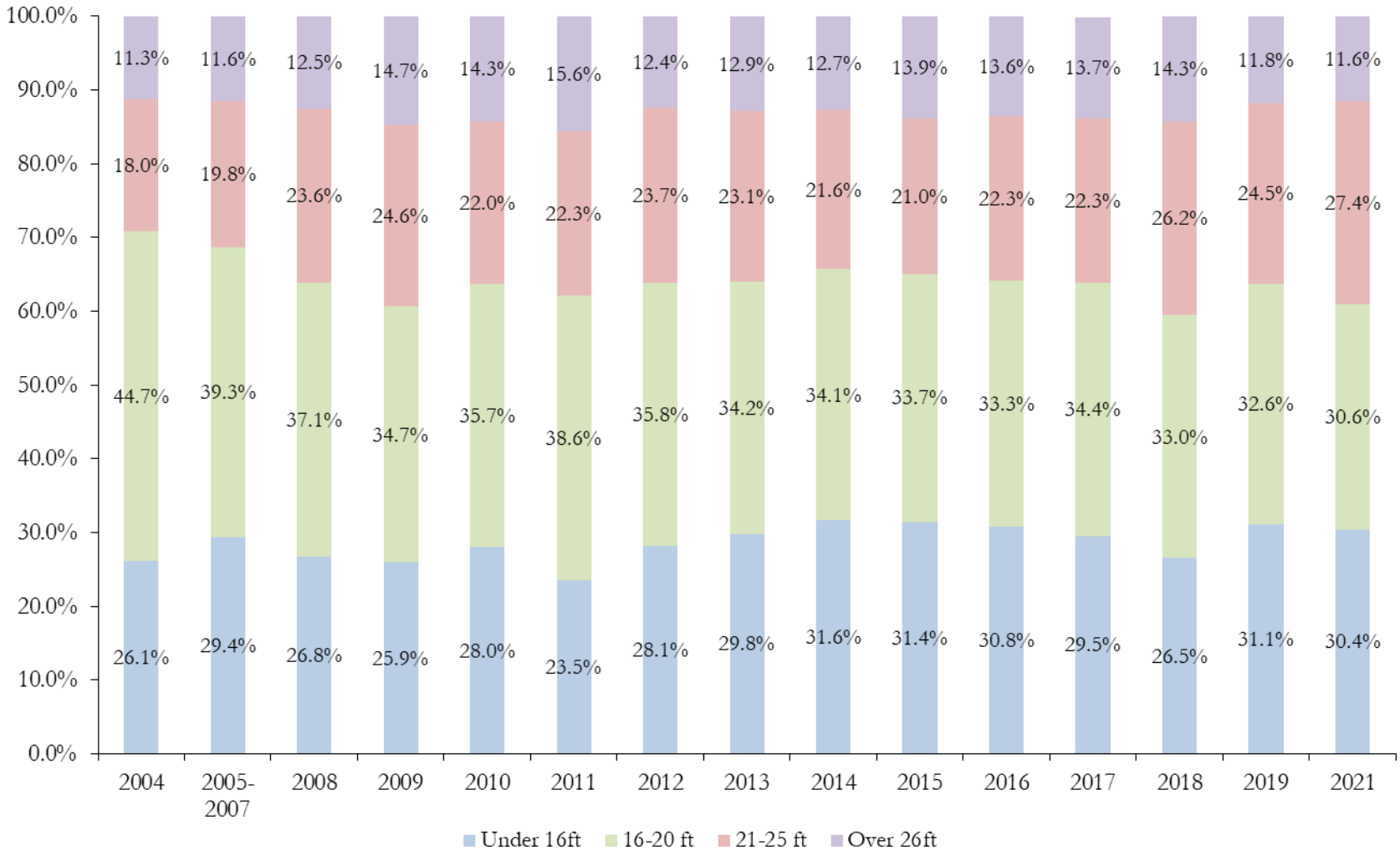
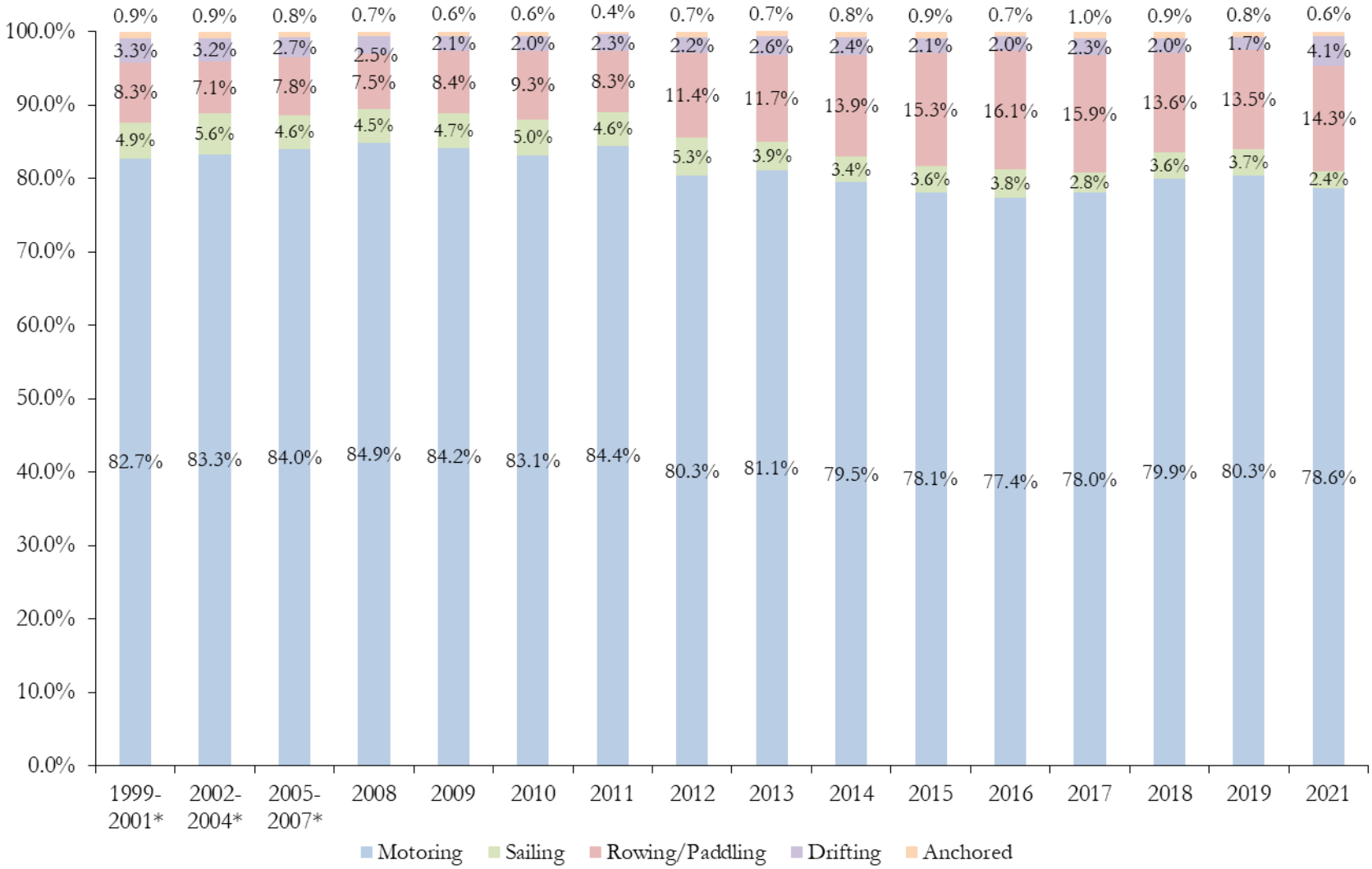
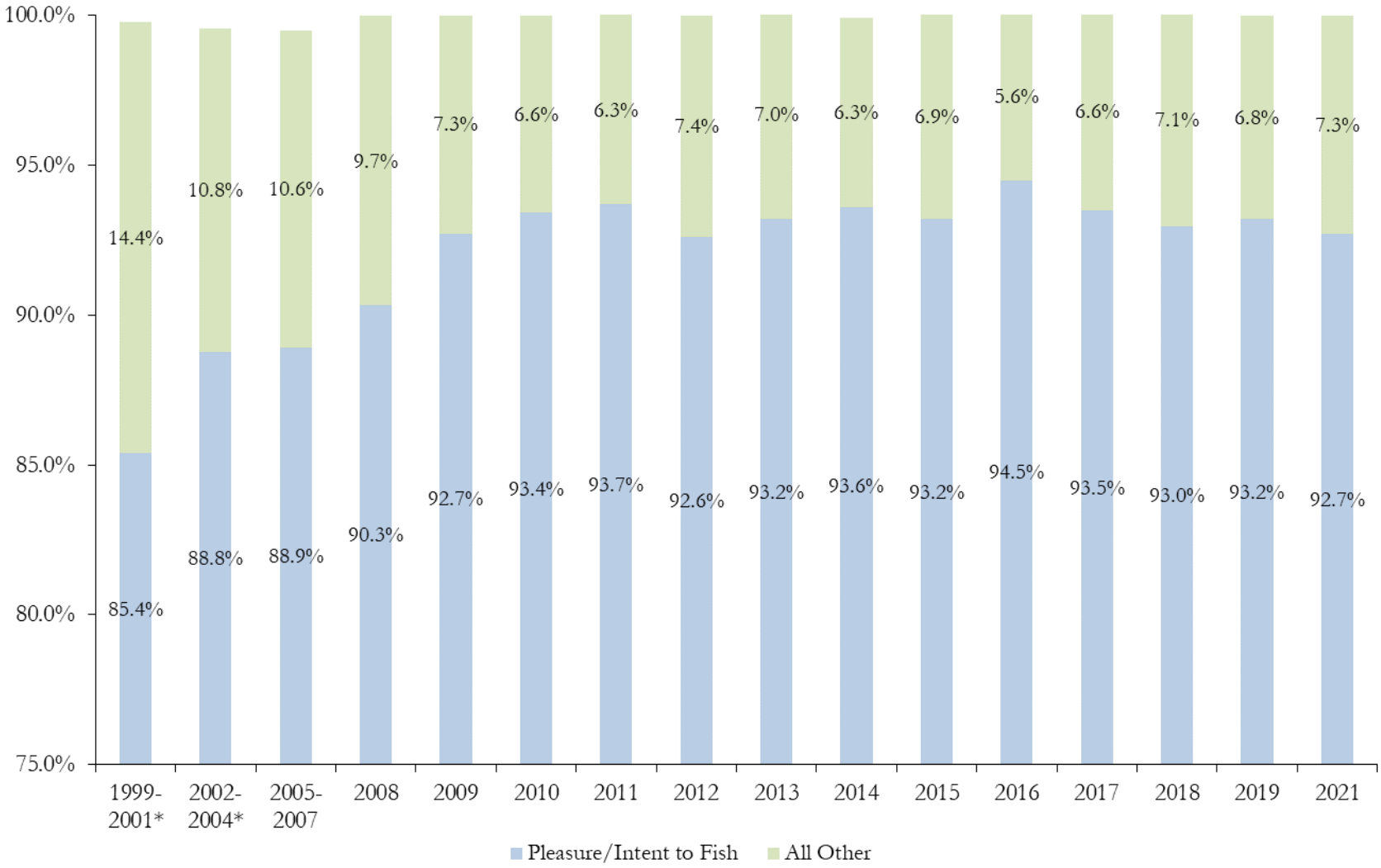


Figure S – Operation of Boats



*Three-year average

Figure T1 – Activity of Boaters—ALL YEARS*



*Three-year average

Figure T2 – Activity of Boaters 2007-2021 Data

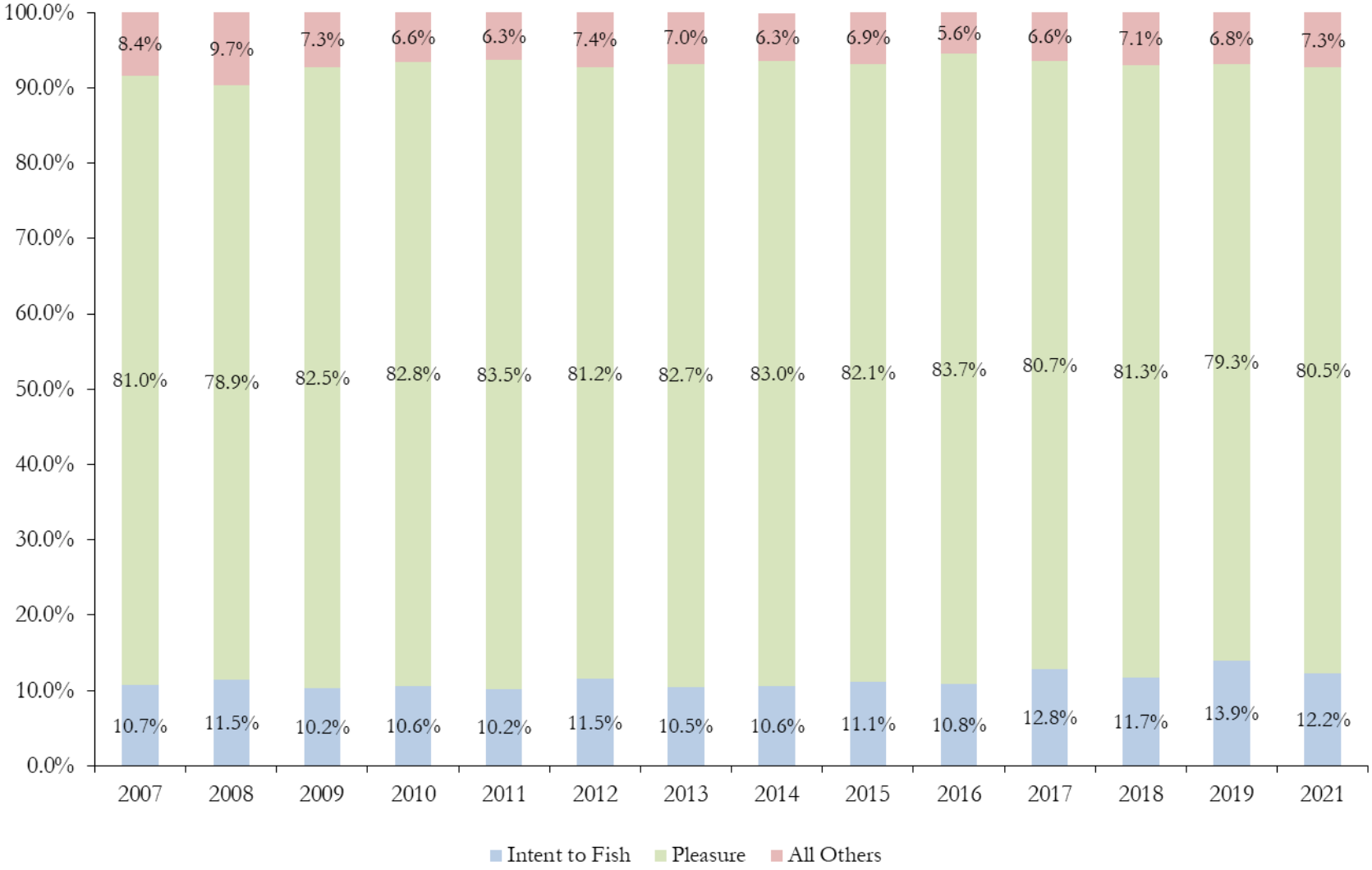
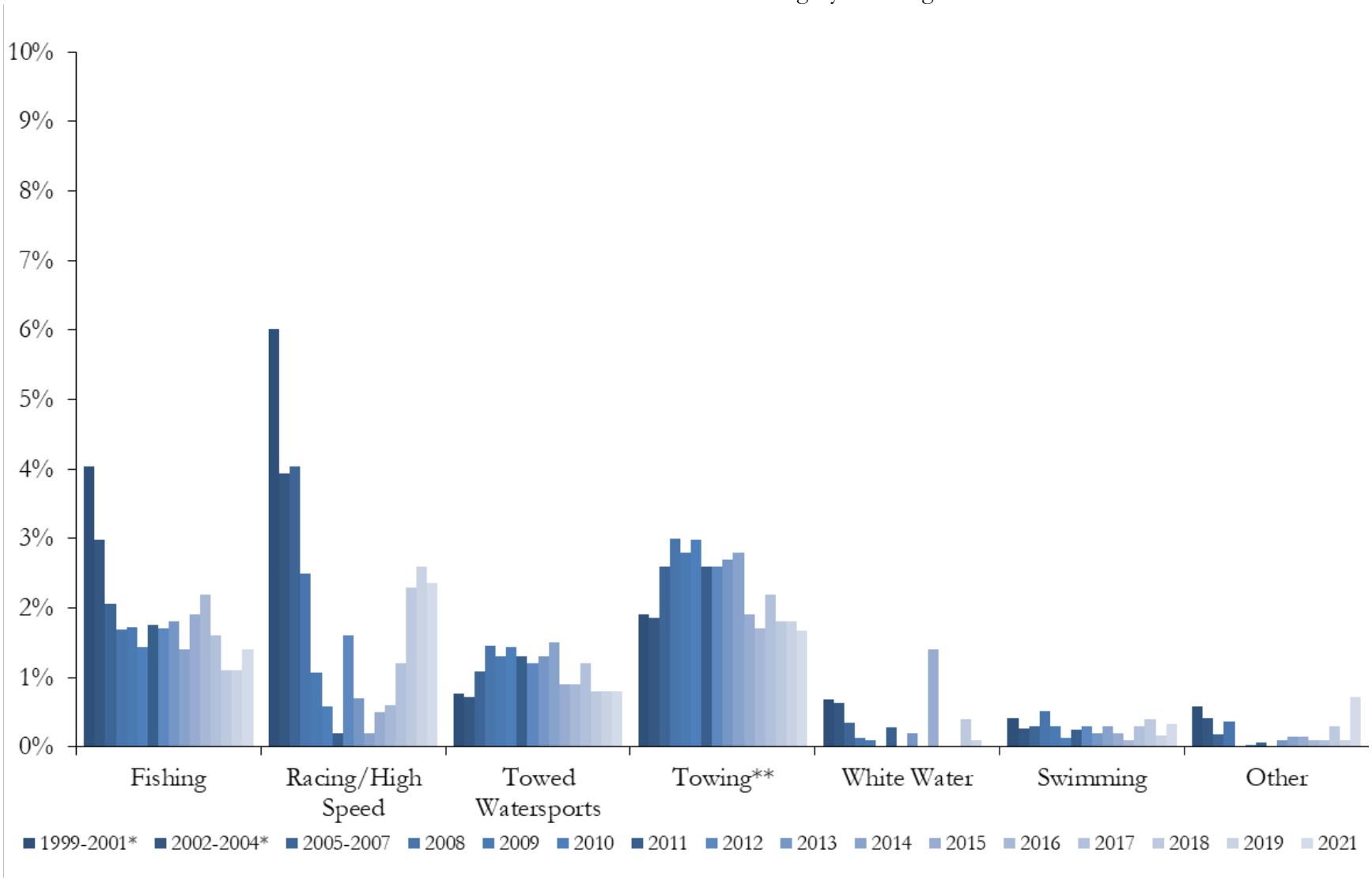


Figure T3 – Activity of Boaters 2002-2021

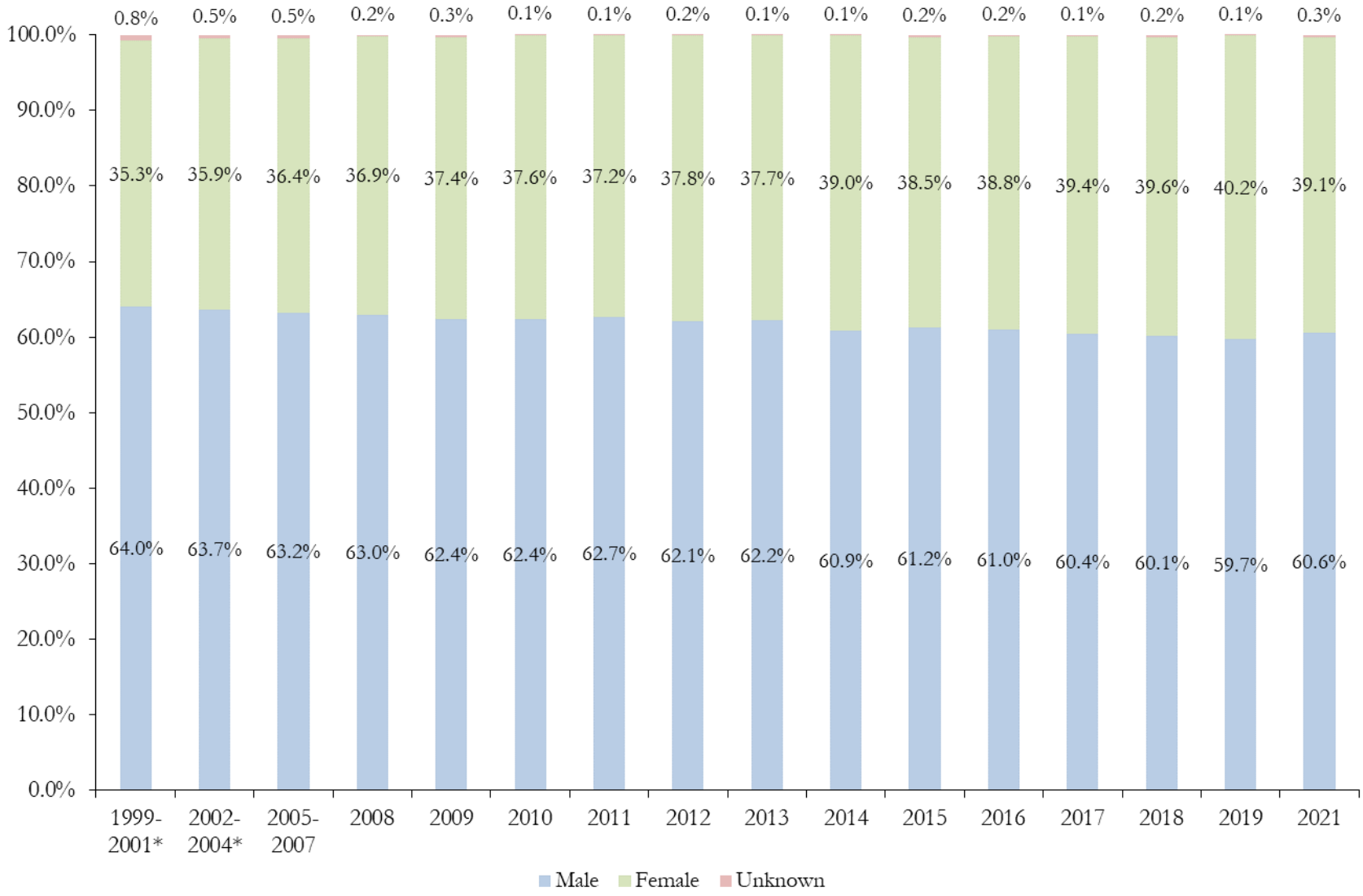
Detailed Breakdown of ALL OTHER Category from Figure T2



*Three-year average

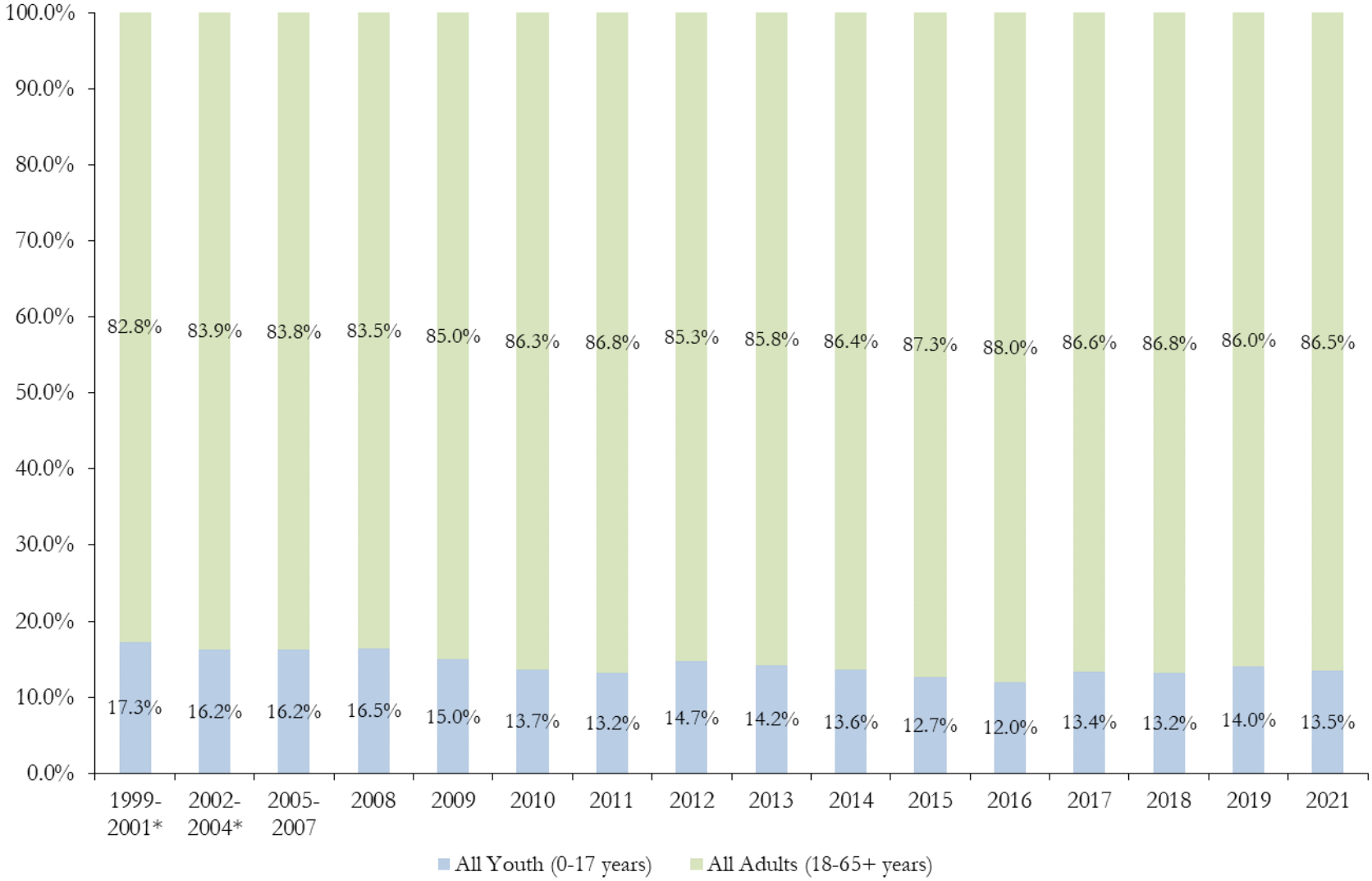
**The activity "Towing" indicates that these boaters were passengers in a boat towing water-skiers or other towing activities. Likewise, "Towed Watersports" includes all towing sports and is reserved for the boaters in the water being towed. The label was changed in April 2010.

Figure U – Gender of Boaters



*Three-year average

Figure V1 – Age of Boaters

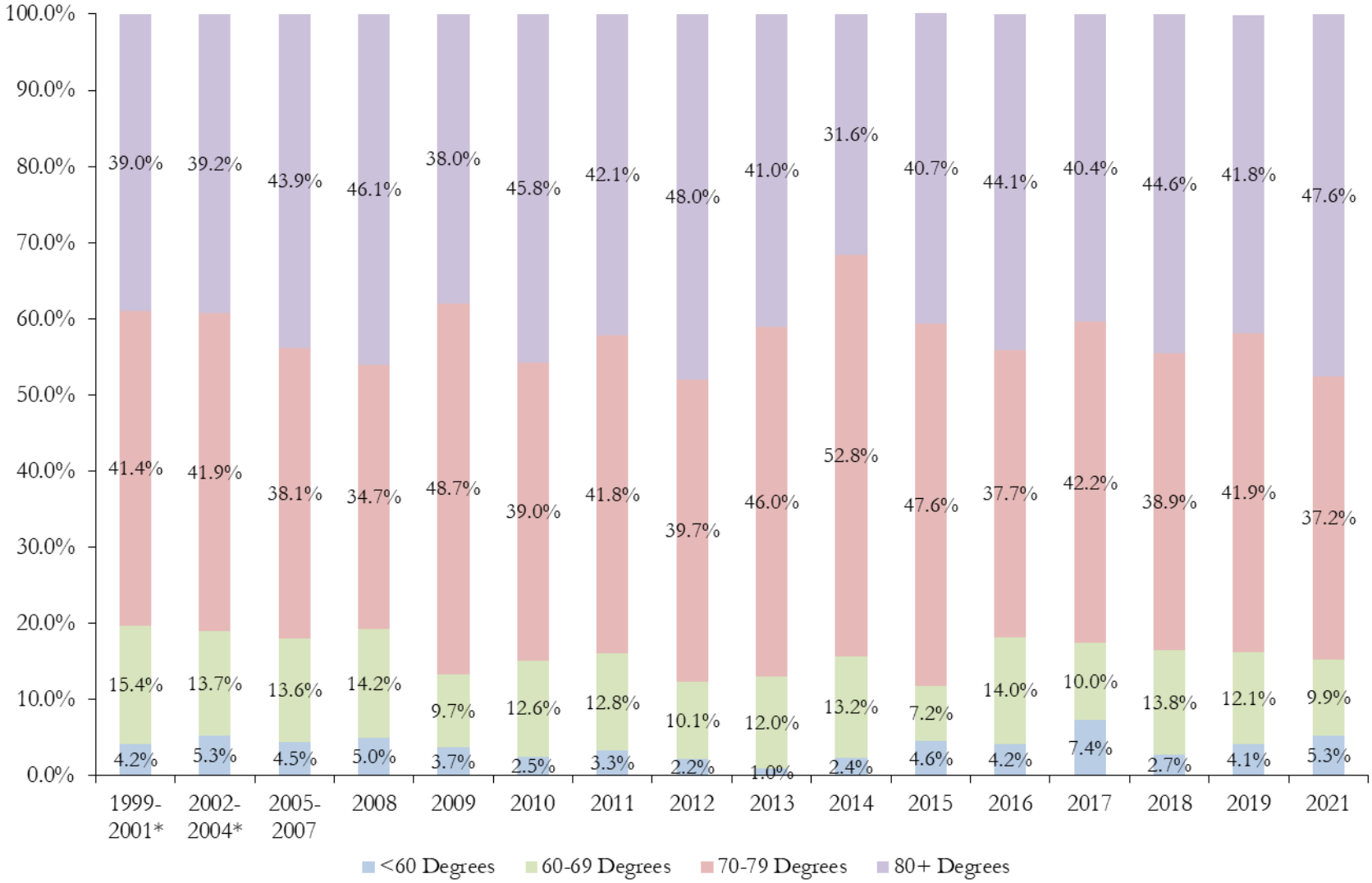


*Three-year average

Figure V2 – Age of Youth Boaters

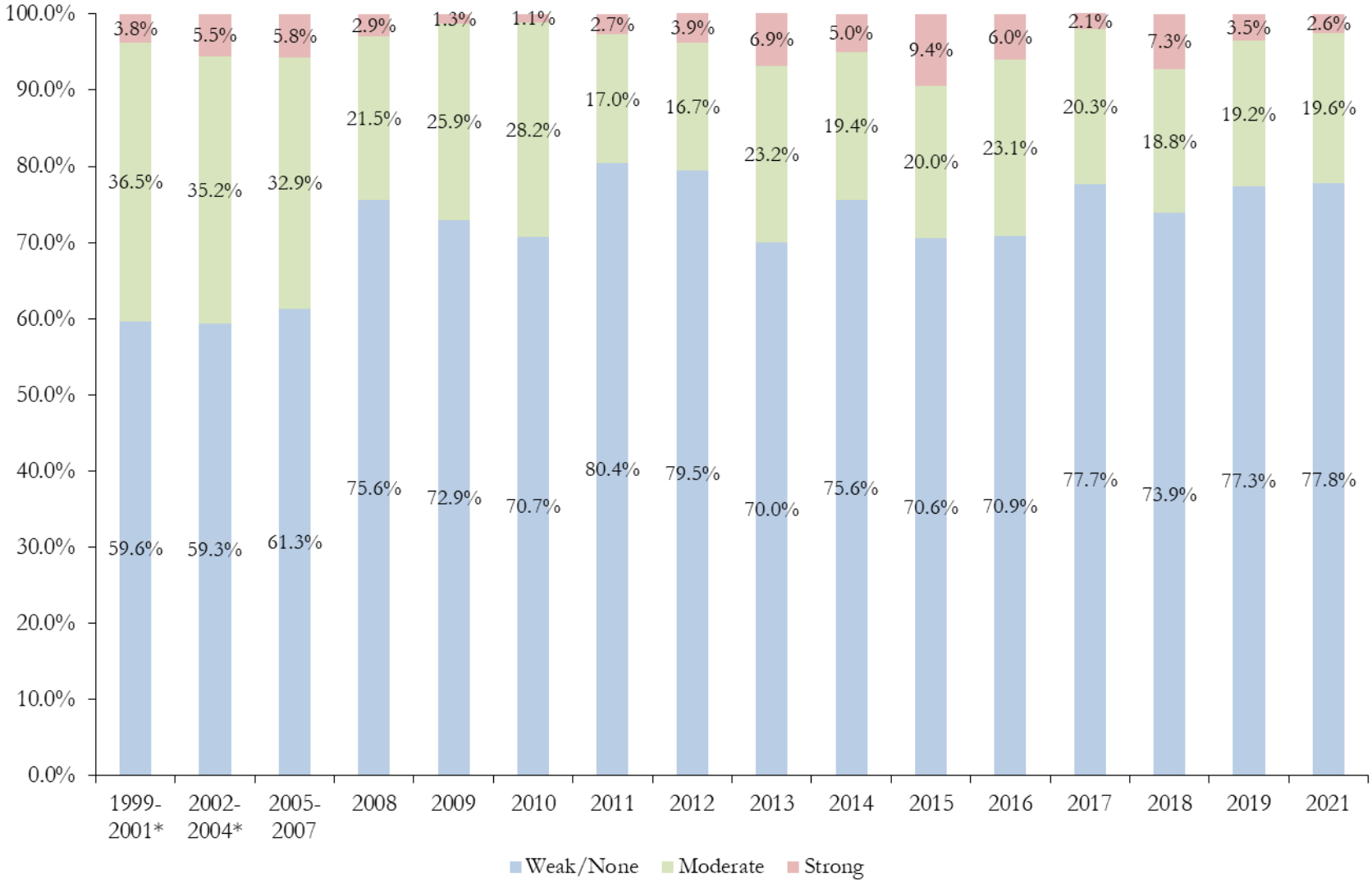
*Three-year average

Figure W – Water Temperature in which ALL Boaters were Observed



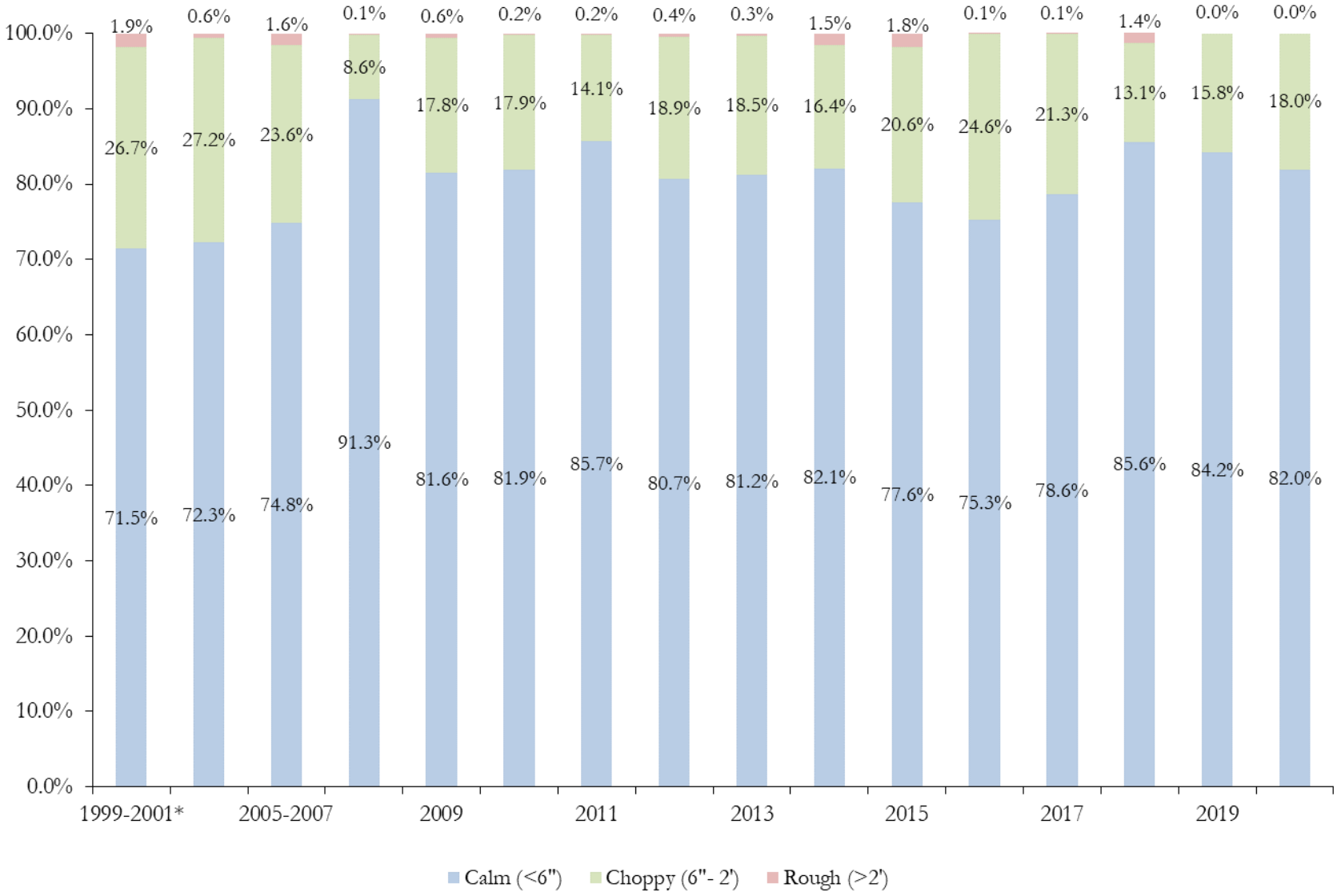
*Three-year average

Figure X – Water Current in which ALL Boaters were Observed



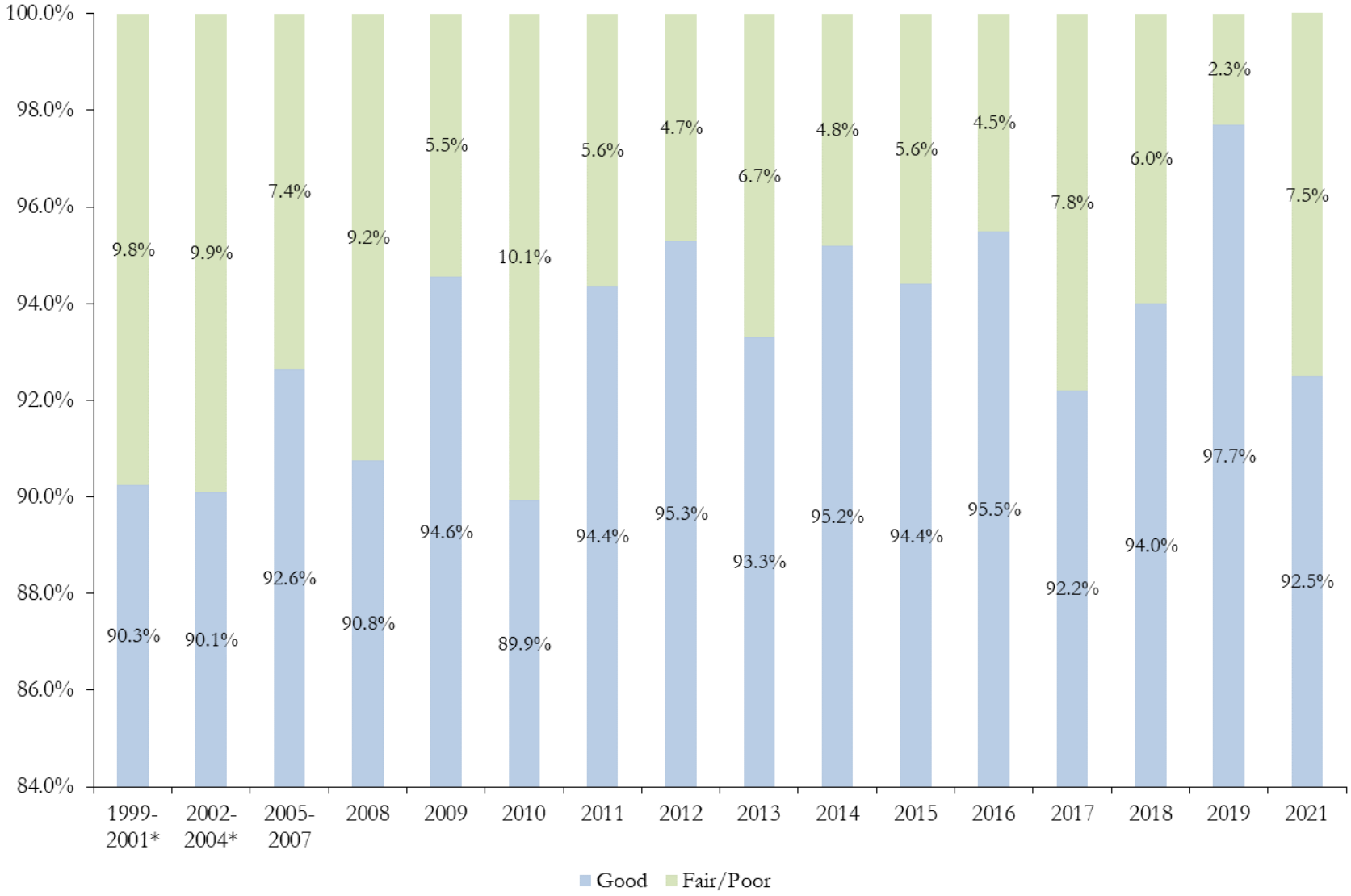
*Three-year average

Figure Y – Wave Height in which ALL Boaters were Observed



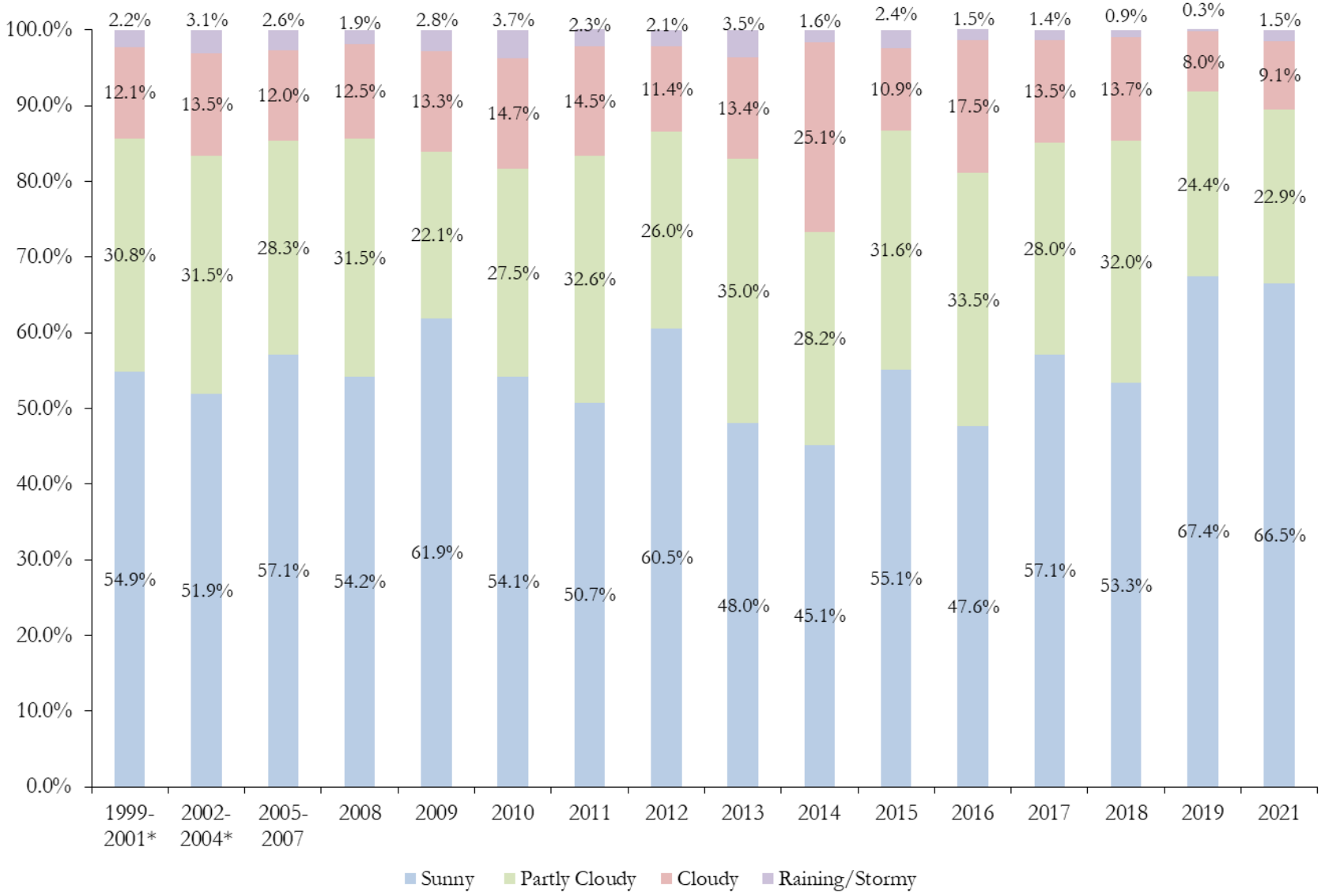
*Three-year average

Figure Z – Visibility in which ALL Boaters were Observed



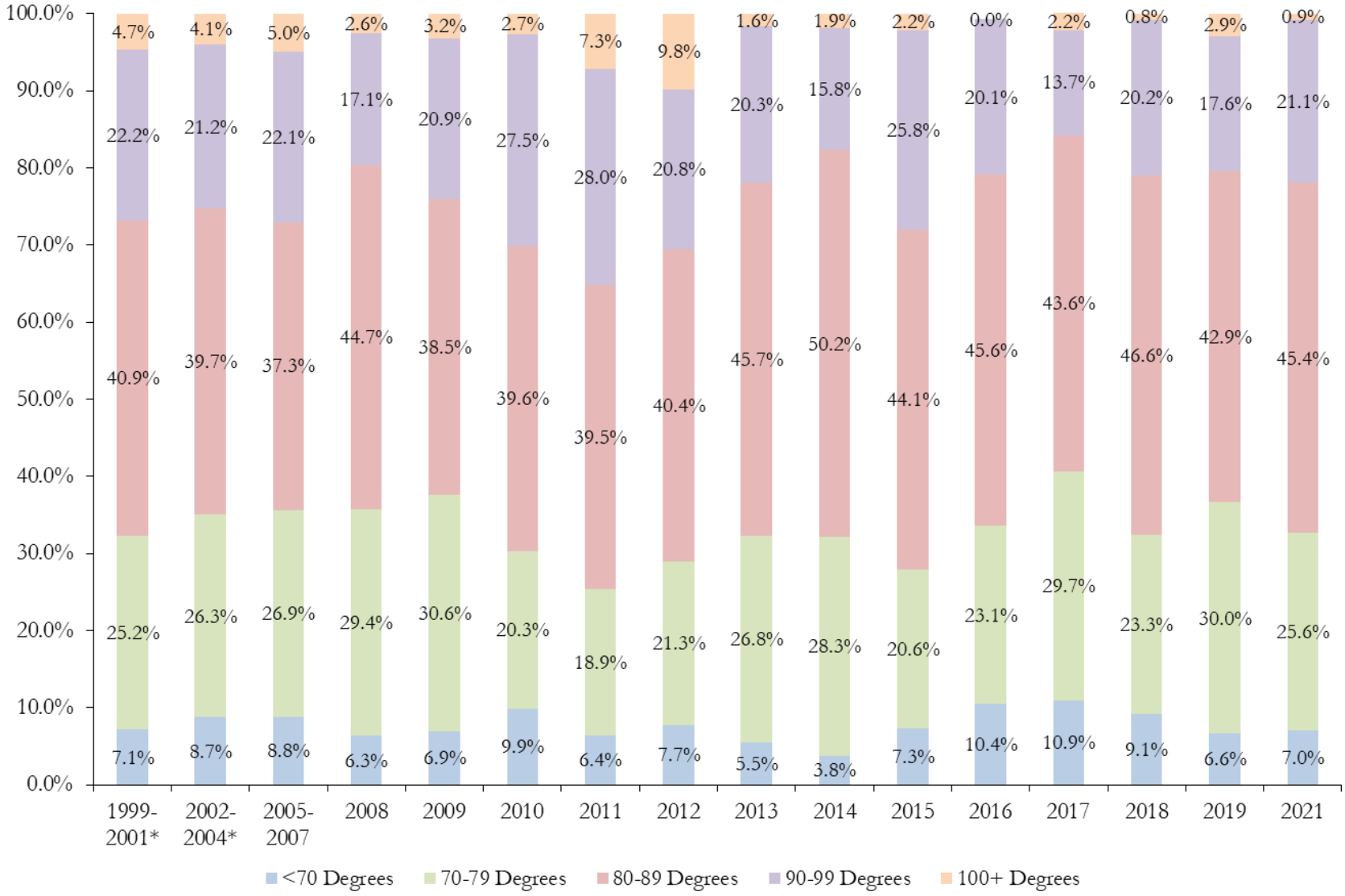
*Three-year average

Figure AA – Weather in which ALL Boaters were Observed



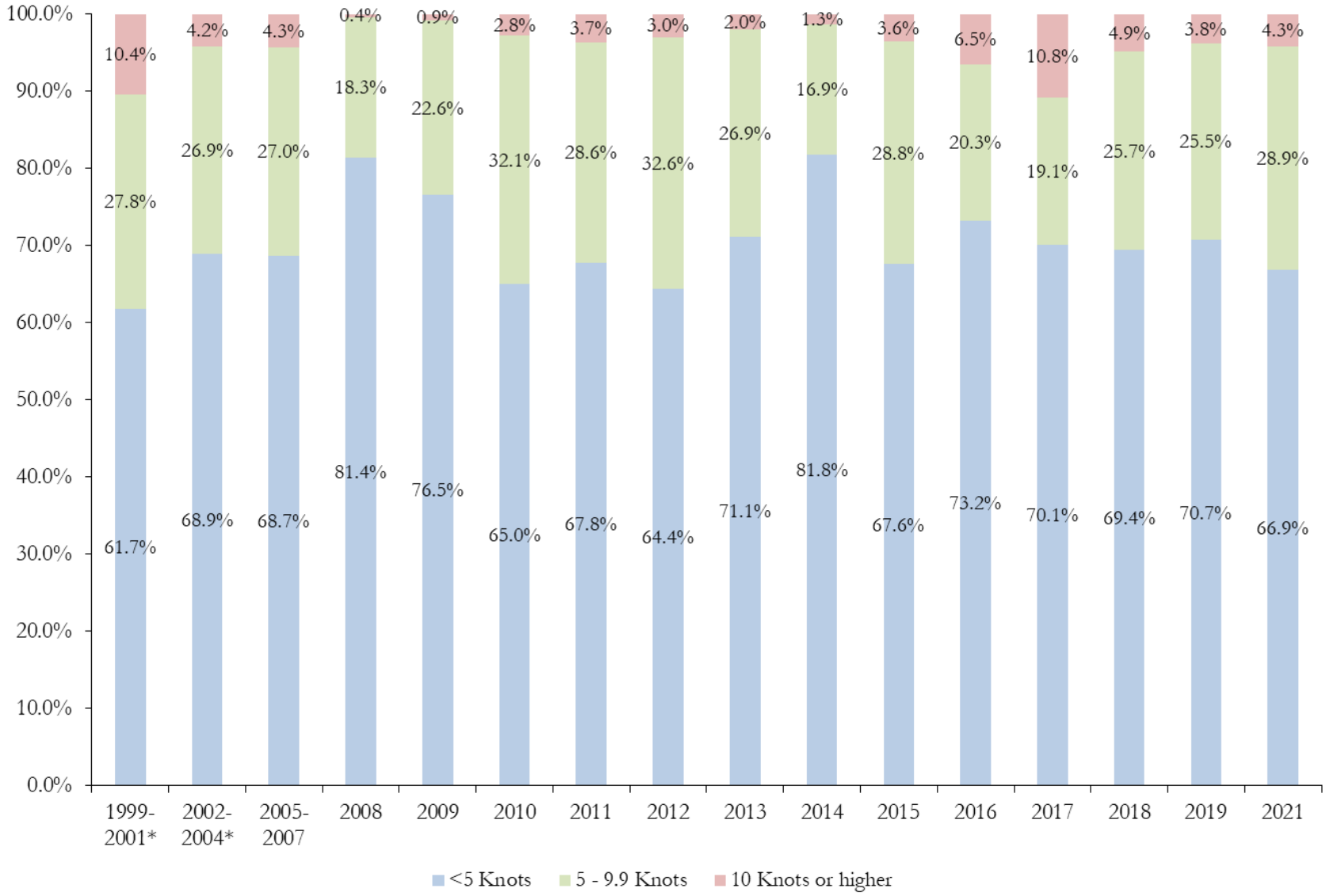
*Three-year average

Figure AB – Air Temperature in which ALL Boaters were Observed



*Three-year average

Figure AC – Wind Speed in which ALL Boaters were Observed



*Three-year average