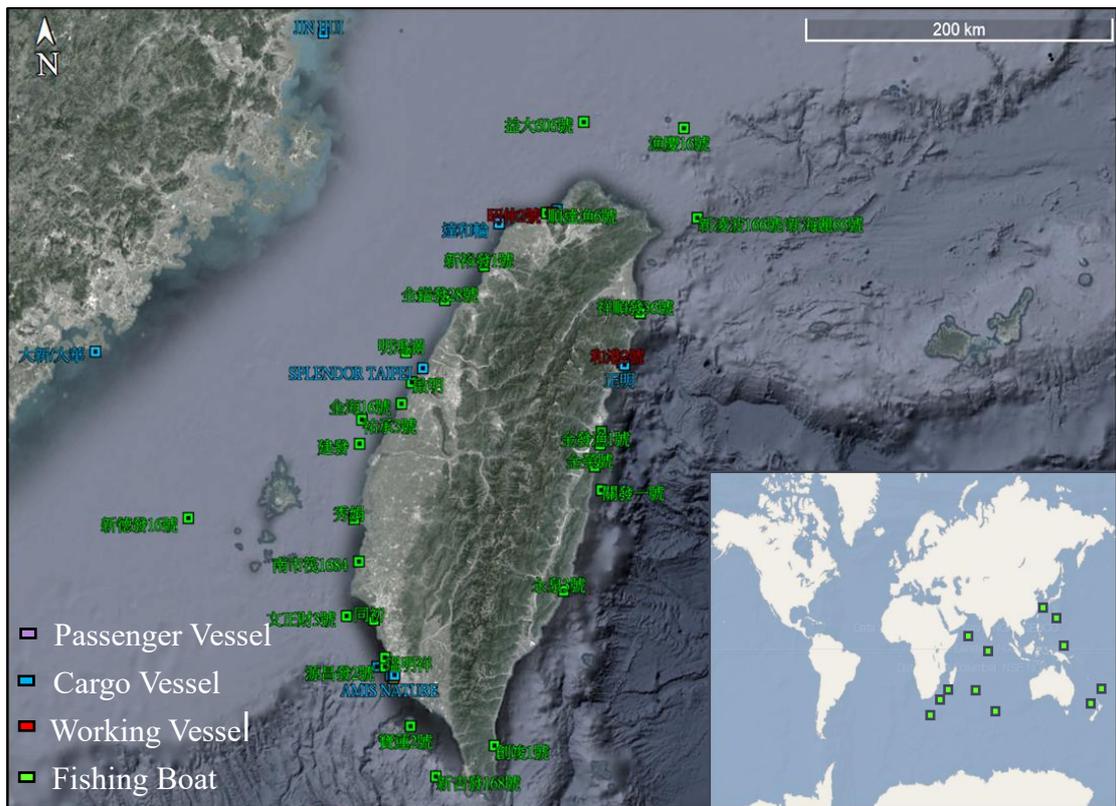


2021 Taiwan Marine Occurrence Statistics



Taiwan Transportation Safety Board



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Summary

The number of merchant vessels registered in Taiwan over 100 gross tonnage (GT) were remaining steady between 267 GT to 300 GT over the past decade. However, the total registered GT and deadweight tonnage (DWT) increased slowly, especially the bulk carrier and container.

The number of Taiwan fishing boats was remaining steady over the past decade. However, the number of fishing boats over 100 GT dropped, but the number over 1000 GT has slightly increased.

The marine occurrences that occurred involving merchant vessels from 2016 to 2020 were caused over 100 casualties per year. Collision, Machinery Damage, and Contact were the top 3 most frequently occurring accident types among all casualty categories. The marine occurrences occurred mostly in January, August, September, October, and December. Water area under the jurisdiction of the South Maritime Affairs Center had the highest number in marine casualty occurrence. The frequency of occurrence of the ships under 5000 GT and over 15000 GT were the highest. Vessel over 15 of age had the highest number of occurrences. The rate of marine casualties involving General Cargo, Container, Bulk carrier, Oil/Chemical Tanker, Tug, and Passenger were higher than those of the other vessel types. The severity for most of the shipping occurrences were of the “Marine Casualty” category.

Overall, the number of marine occurrences from 2016 to 2020 was less than the number from 2011 to 2015 for fishing boats. The marine occurrence of fishing boats most occurred in January and less in February to April. The water area under the jurisdiction of the South Maritime Affairs Center had the highest number in marine casualty occurrence. The types of fishing boats which occurred the marine occurrence frequently were the Powered fishing crafts, followed by Fishing rafts and Powered sampans. Ship/ Equipment damage had the highest number in occurrence, and others were collision, man falling overboard, and grounding in order. Most fishing boats had hull damage when encountering marine occurrences.

Taiwan Transportation Safety Board (TTSB) is the agency responsible for major transportation occurrences investigation which included aviation, marine, railway and highway occurrences. TTSB will investigate those marine occurrences if they meet the scope of major marine occurrence. Marine occurrence investigation is classified into

class 1, 2 and 3. From the establishment of the TTSB on 1 August 2019 to 31 December 2020, 89 cases out of 284 notifications of marine occurrences were under investigation. From 1 August 2019 to 31 December 2020, 18 of 26 marine safety recommendations were still waiting for a reply from the government authorities concerned. Additionally, 5 recommendations were under supervised by the Executive Yuan and 3 recommendations were closed.

1. Introduction

The first section of this report is the current status of Taiwan-Flagged merchant fleet over 100 GT as well as fishing vessels in a decade based on the data from Ministry of Transportation and Communications (MOTC) and Fisheries Agency, Council of Agriculture (FA, COA).

The second section contains the statistical analysis of marine accidents involving merchant and fishing vessels accordingly. In the part of the merchant vessel contains the statistical analysis of merchant vessel accidents. The analysis is conducted in terms of casualty type, GT, Nationality, ship age, ship type, occurrence locations, and accident severity. Pairwise comparisons between casualty type, casualty severity and each of the aforementioned elements are subsequently conducted. In the part of fishing vessel part, on the other hand, addresses the statistical analysis of fishing vessel accidents. The analysis is implemented in the aspects of casualty type, vessel type, occurrence locations, GT, annual and monthly occurrences. Pairwise comparisons are also performed in terms of casualty type, casualty severity, and each of the aforementioned factors.

The third section stated the major marine occurrence statistics of TTSB. First of all, the scope of major marine occurrences will be defined. Secondly, the severity classification of investigation will be introduced, and the major marine occurrence investigation and its casualty type will be analyzed as well. Last but not least, follow-up the states of transportation safety recommendations.

An appendix is established in this report, containing the definition of maritime terminologies according to Casualty Investigation Code.

2. Current Status of Taiwan-Flagged Fleet

2.1 Merchant fleet over 100 GT

Table 1 and Figure 1 show the number of vessels, gross tonnage (GT) and deadweight tonnage (DWT) of the Taiwan-Flag merchant fleet over 100 GT between 2011-2020 based on the annual Transportation Report published by the Ministry of Transportation and Communications (MOTC), R.O.C. Figure 1 indicates the number of vessels registered had a slight increase from 2010 to 2015, and a declined trend is spotted since 2015 to 2019. However, the number of registered vessels had rebounded to 300 in 2020. There is a gradual decline of GT and DWT in 2016 and 2017, rising to 4.91 and 7.57 million tons in 2020.

Table 1. Number of ship registry, GT and DWT of Taiwan-Flag merchant fleet 2011-2020

Year	Registered Vessels	GT	DWT (Ton)
2011	290	2,888,558	4,493,037
2012	288	3,113,599	4,672,453
2013	295	3,373,753	4,977,349
2014	304	3,635,946	5,284,951
2015	313	3,847,758	5,481,654
2016	278	3,463,074	4,958,454
2017	283	3,578,719	5,120,324
2018	267	4,173,822	6,136,249
2019	285	4,723,929	7,110,663
2020	300	4,913,161	7,571,142

Source: MOTC Department of Statistics

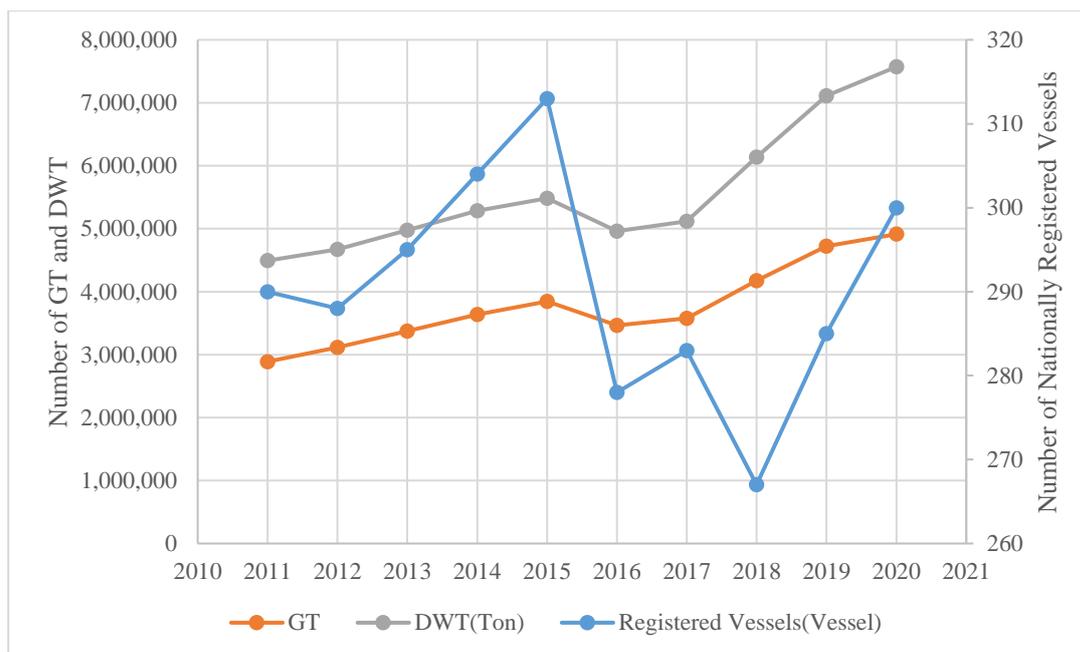


Figure 1. Number of ship registry, GT and DWT of Taiwan-Flag merchant fleet 2011-2020

Table 2 lists the number of vessels under Taiwanese registry in terms of ship type from 2011 to 2020. General dry cargo vessel has the highest quantity before 2016 whereas the number of container has a gradual increase during the 10-year period of time according to Table 2. Number of Taiwan-Flag vessels by ship type 2011-2020 and Figure 2. The numbers of the bulk carrier and tanker under the registry remain steady during the period. The General dry cargo vessel has the highest quantity in 2020, followed by the passenger vessel, container, other purpose-built vessel, bulk carrier, and tanker.

Table 2. Number of Taiwan-Flag vessels by ship type 2011-2020

Year	General dry cargo	Bulk Carrier	Container	Tanker	Passenger	Other	Total
2011	92	21	38	22	64	53	290
2012	86	23	41	18	65	55	288
2013	88	21	47	19	68	52	295
2014	90	20	50	20	71	53	304
2015	92	20	51	20	77	53	313
2016	73	14	51	18	73	49	278
2017	69	16	53	21	76	48	283
2018	60	18	59	19	72	39	267
2019	63	25	61	18	77	41	285
2020	78	27	60	18	72	45	300

Source: MOTC Department of Statistics

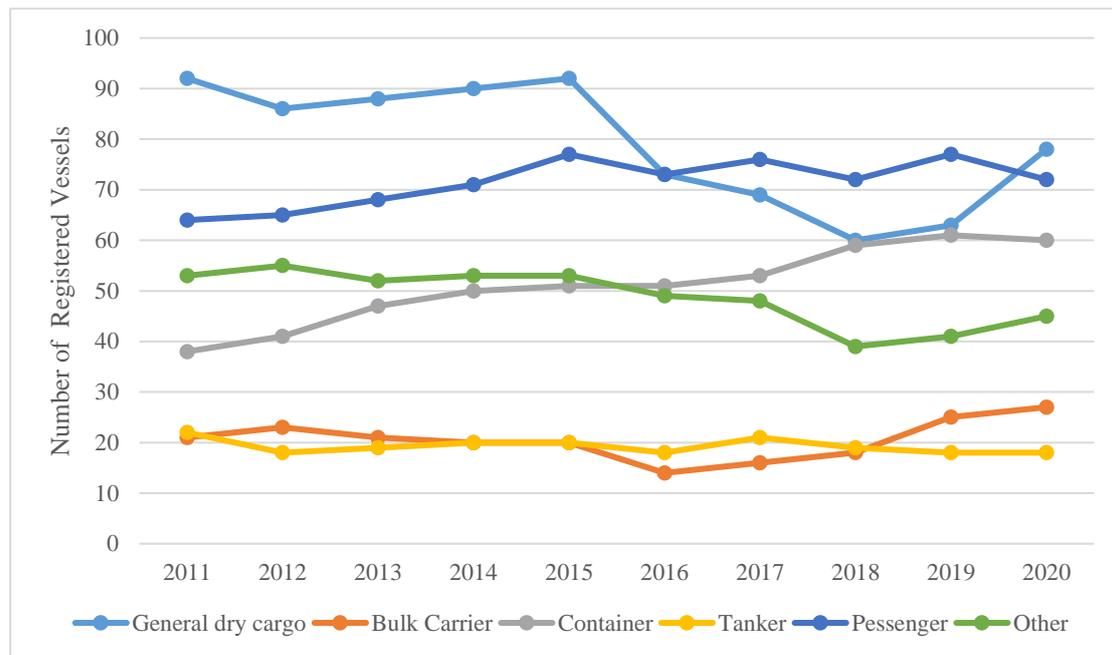


Figure 2. Number of Taiwan-Flag vessels by ship type 2011-2020

Table 3 shows the DWT of vessels under the Taiwanese registry in terms of ship type from 2011 to 2020. According to Table 3 and Figure 3, the DWT of bulk is higher than others, rising from 1.51 million in 2017 to 3.69 million in 2020. While the DWT of container and passenger had a gradual rise, tanker experienced a dramatic decrease from 2010 to 2012 and increased after 2017. In addition, the DWT of general dry cargo has a significant increase in 2020 and a steady increase in purpose-built vessels.

Table 3. DWT of Taiwan-Flagged vessels by ship type 2011-2020

Year	General dry cargo	Bulk Carrier	Container	Tanker	Passenger	Other	Total
2011	335,475	1,735,891	836,405	716,694	6,539	862,033	4,493,037
2012	319,376	2,014,137	1,139,710	193,183	7,395	998,652	4,672,453
2013	338,324	2,017,059	1,411,984	193,856	8,271	1,007,855	4,977,349
2014	338,620	1,984,317	1,712,685	198,855	8,183	1,042,291	5,284,951
2015	354,548	1,984,282	1,892,457	198,855	9,221	1,042,291	5,481,654
2016	329,237	1,484,214	1,891,672	197,541	9,170	1,046,620	4,958,454
2017	307,705	1,515,483	1,946,903	294,866	9,292	1,046,075	5,120,324
2018	284,378	2,343,364	2,170,916	293,785	8,932	1,034,874	6,136,249
2019	278,177	3,224,593	2,260,372	249,332	9,511	1,088,678	7,110,663
2020	380,957	3,690,718	2,248,852	208,459	9,345	1,032,811	7,571,142

Source: MOTC Department of Statistics

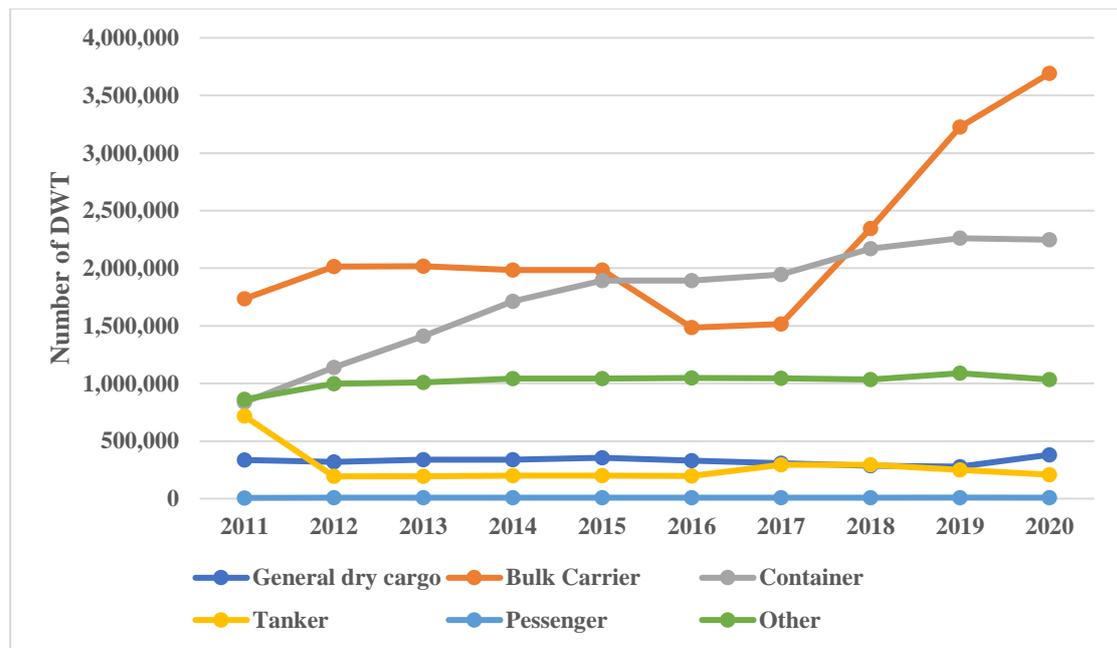


Figure 3. DWT of Taiwan-Flag vessels by ship type 2011-2020

Table 4 shows the number of vessels under the Taiwanese registry over 100 GT in terms of ship age from 2011 to 2020. Table 4 and Figure 4 indicate that the category of ships over 21 years old has the highest amount in comparison with the other 4 age groups, reaching its maximum quantity to 155 in 2015. The number of 21-year old ships is two times higher than those of 11-15 and 16-20 age groups and 3 or 4 times more than those of the other 4 age fleets. In addition, the number of ships under 5 years old steadily grows during the period.

Table 4. Number of Taiwan-Flag vessels by ship age 2011-2020

Year	Under 5 years	6-10 years	11-15 years	16-20 years	Over 21 years	Total
2011	18	21	53	69	129	290
2012	19	25	45	69	130	288
2013	21	31	37	75	131	295
2014	30	24	37	66	147	304
2015	36	23	29	70	155	313
2016	30	22	33	56	137	278
2017	29	18	43	53	140	283
2018	39	22	38	40	128	267
2019	46	38	30	44	127	285
2020	61	48	26	30	135	300

Source: MOTC Department of Statistics

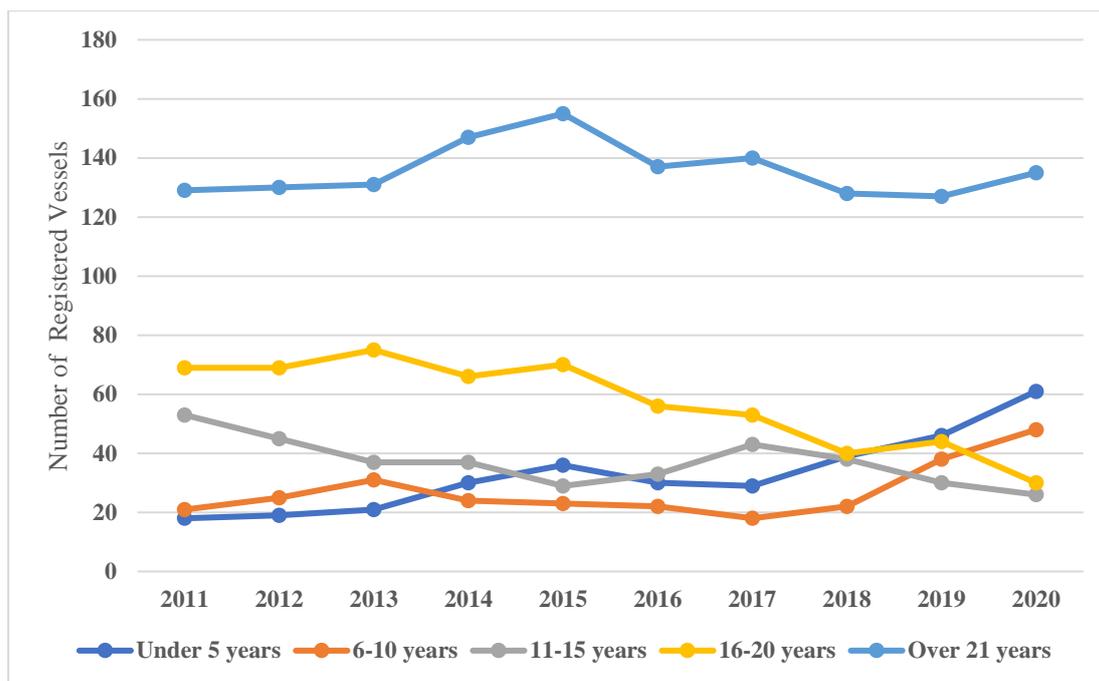


Figure 4. Number of Taiwan-Flag vessels by ship age 2011-2020

Table 5 lists the DWT of Taiwan-Flag vessels in terms of ship age from 2011 to 2020. According to Table 5 and Figure 5, the ship age under 5 years old shows a gradually increase before 2015 and after 2018 meanwhile experienced a slight decline in 2016 and 2017. The DWT of the 6-10 age group has a consistent rise during the period.

Table 5. DWT of Taiwan-Flag vessels by ship age 2011-2020

Year	Under 5 years	6-10 years	11-15 years	16-20 years	Over 21 years	Total
2011	505,029	478,687	1,518,092	1,097,044	894,185	4,493,037
2012	1,198,328	384,200	1,271,283	1,012,396	806,246	4,672,453
2013	1,507,932	691,903	813,927	1,154,793	808,794	4,977,349
2014	1,994,068	868,583	705,538	861,856	854,906	5,284,951
2015	2,123,121	698,902	546,250	1,286,817	826,564	5,481,654
2016	1,678,054	1,028,301	802,168	589,025	860,906	4,958,454
2017	1,069,007	1,282,226	990,257	938,176	840,658	5,120,324
2018	1,401,569	2,004,072	988,142	772,470	969,996	6,136,249
2019	1,795,764	2,675,277	965,097	738,164	936,361	7,110,663
2020	2,353,386	3,094,820	881,440	219,109	1,022,387	7,571,142

Source: MOTC Department of Statistics

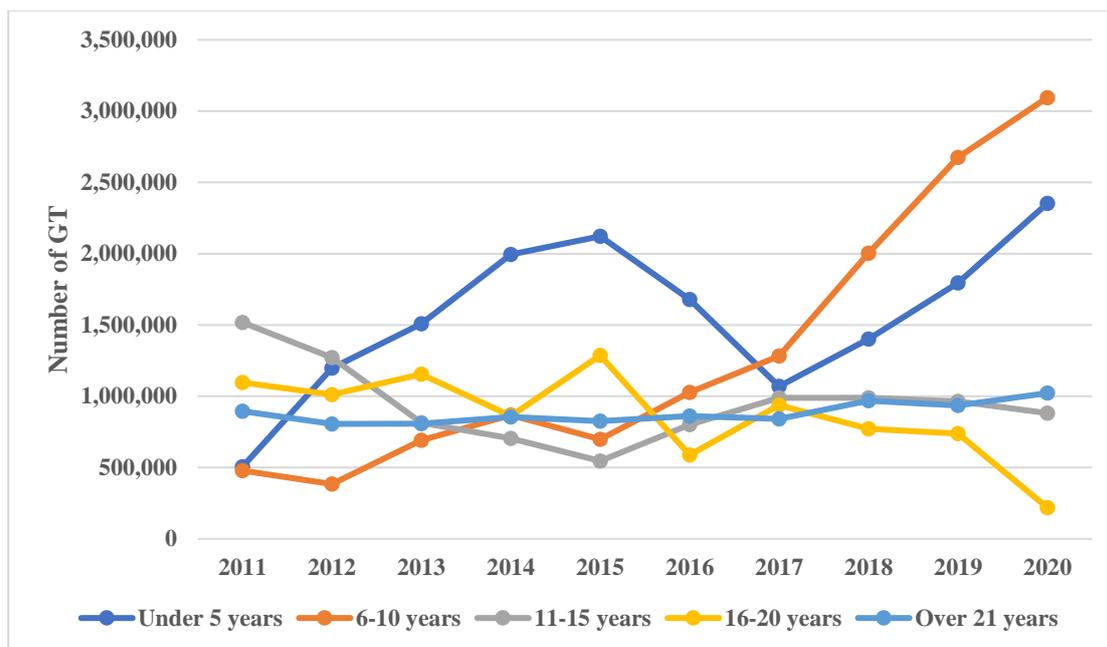


Figure 5. DWT of Taiwan-Flag vessels by ship age 2011-2020

Table 6 shows the average age of Taiwan-Flag vessels over 100 GT in terms of ship type between 2011 and 2020. The average ship age has a slight increase from 2011 to 2015 and a decline between 2016 and 2020 except the passenger vessel and container. Table 6 and Figure 6 indicate that general dry cargo is the ship type that has the oldest age among the vessel categories. The average ship age of the bulk carrier had a significant descending trend since 2015. The average figures of container, tanker, passenger, and other purpose-built vessels also had a slight decrease until 2019.

Table 6. Average age of Taiwan-Flag vessels by ship type 2011-2020

Year	General dry cargo	Bulk Carrier	Container	Tanker	Passenger	Other
2011	28	16	15	18	16	19
2012	29	15	14	19	16	19
2013	29	16	13	20	17	20
2014	29	17	13	20	17	21
2015	30	18	12	21	17	22
2016	25	14	13	21	16	22
2017	26	15	13	18	16	23
2018	27	11	13	18	16	21
2019	24	10	13	17	16	20
2020	21	9	14	17	17	20

Source: MOTC Department of Statistics

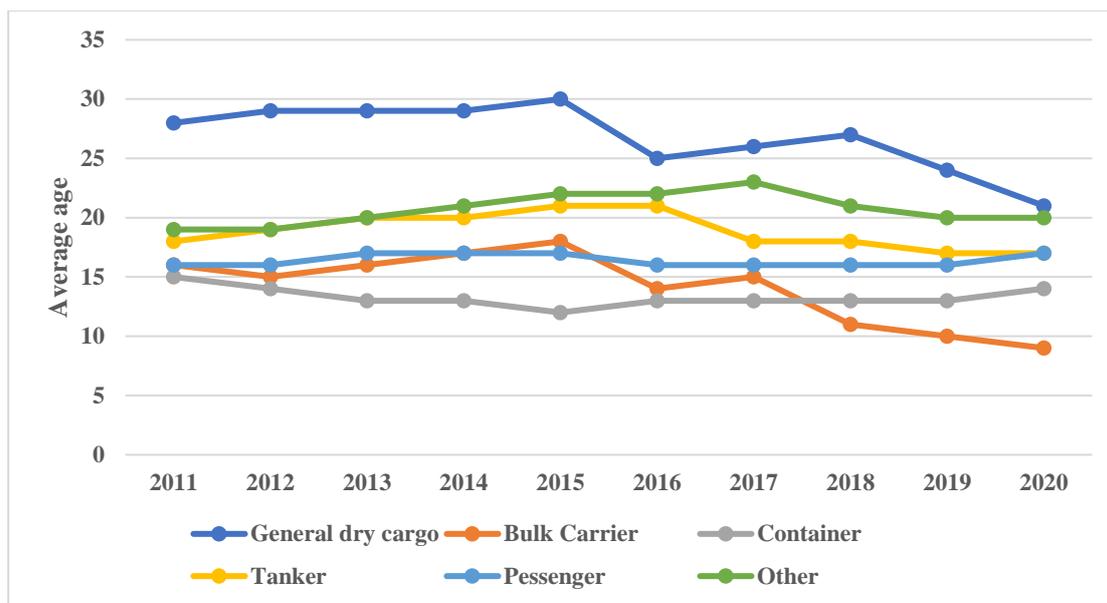


Figure 6. Average age of Taiwan-Flag vessels by ship type 2011-2020

2.2 Powered fishing crafts

Table 7 and Figure 7 list the number of Taiwanese powered fishing crafts in terms of GT from 2011 to 2020. In summary, the annual number of each GT category has little variations during the period. Over 95% of powered fishing crafts are under 100 GT and the amount of fishing boat under 5 GT slightly increased.

Table 7. Number of Taiwanese powered fishing crafts by GT 2011- 2020

GT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
0-4.9	6,192	6,238	6,443	6,478	6,555	6,605	6,672	6,635	6,659	6,729
5-9.9	816	798	806	804	795	791	786	762	754	766
10-19.9	1,406	1,391	1,399	1,430	1,452	1,441	1,441	1,406	1,403	1,404
20-49.9	1,720	1,725	1,539	1,535	1,533	1,565	1,572	1,565	1,533	1,546
50-99.9	1,362	1,395	1,255	1,226	1,210	1,200	1,183	1,128	1,098	1,077
100-199.9	179	152	149	151	154	156	158	156	154	161
200-499.9	306	240	231	233	244	253	251	235	219	219
500-999.9	280	294	292	270	267	257	235	223	213	208
Over 1000	34	43	45	47	50	50	55	63	68	71
Total	14,306	14,288	14,172	14,188	14,275	14,334	14,370	14,191	14,120	14,201

Source: Fisheries statistical yearbook, Taiwan, Kinmen and Matsu Area (2021)

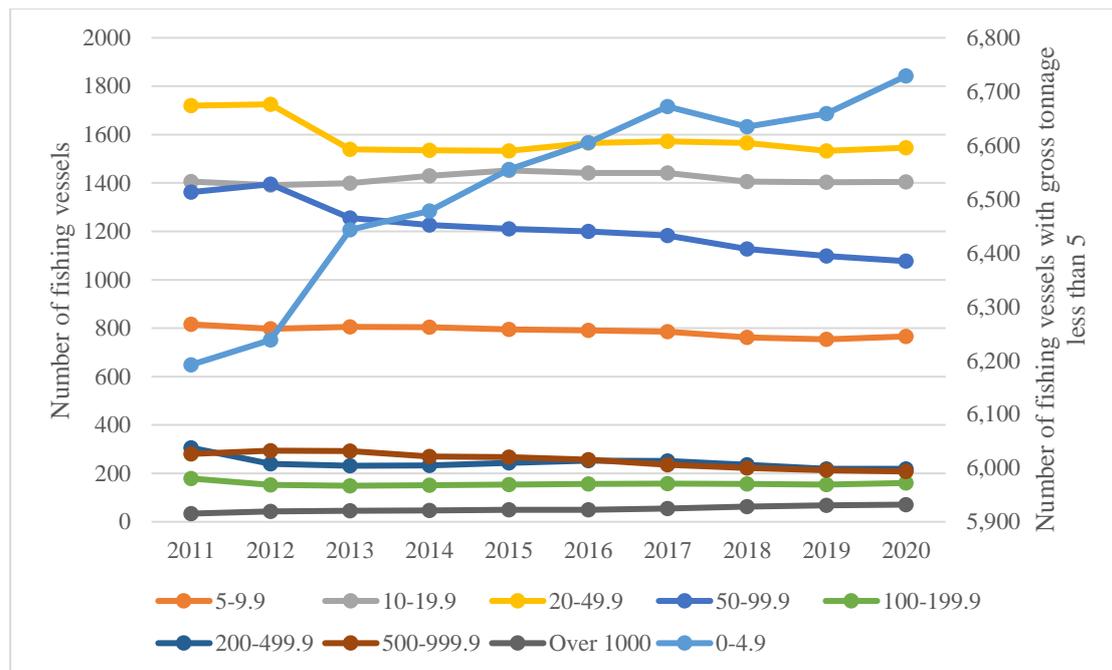


Figure 7. Number of Taiwanese powered fishing crafts by GT 2011- 2020

Table 8 and Figure 8 express the number of each fishing vessel type in terms of GT category in 2020. Among the groups, the long liner is the vessel type that has the highest number in ship quantity, then followed by other liners, gillnetter, trawler, other seiners, and purse seiner, respectively. In addition, powered sampan has large amount among the gill netter, other seiners, long liners, and other liners.

Table 8. Number of each vessel type by GT category in 2020

Tonnage	Trawlers	Purse Seiners	Gill Netters	Seiners others	Long Liners	Liners others	Total
Powered sampans	0	0	1,059	342	1,266	1,954	4,621
0-4.9	22	82	182	292	759	714	2,051
5-9.9	76	5	28	86	483	76	754
10-19.9	162	29	68	114	935	85	1,393
20-49.9	570	2	28	78	839	25	1,542
50-99.9	336	7	6	1	721	4	1,075
100-199.9	115	3	0	0	40	0	158
200-499.9	40	10	0	0	162	0	212
500-999.9	0	3	0	0	124	77	204
Over 1000	0	29	0	0	1	27	57
Total	1,321	170	1,371	913	5,330	2,962	12,067

Source: Fisheries statistical yearbook, Taiwan, Kinmen and Matsu Area (2021)

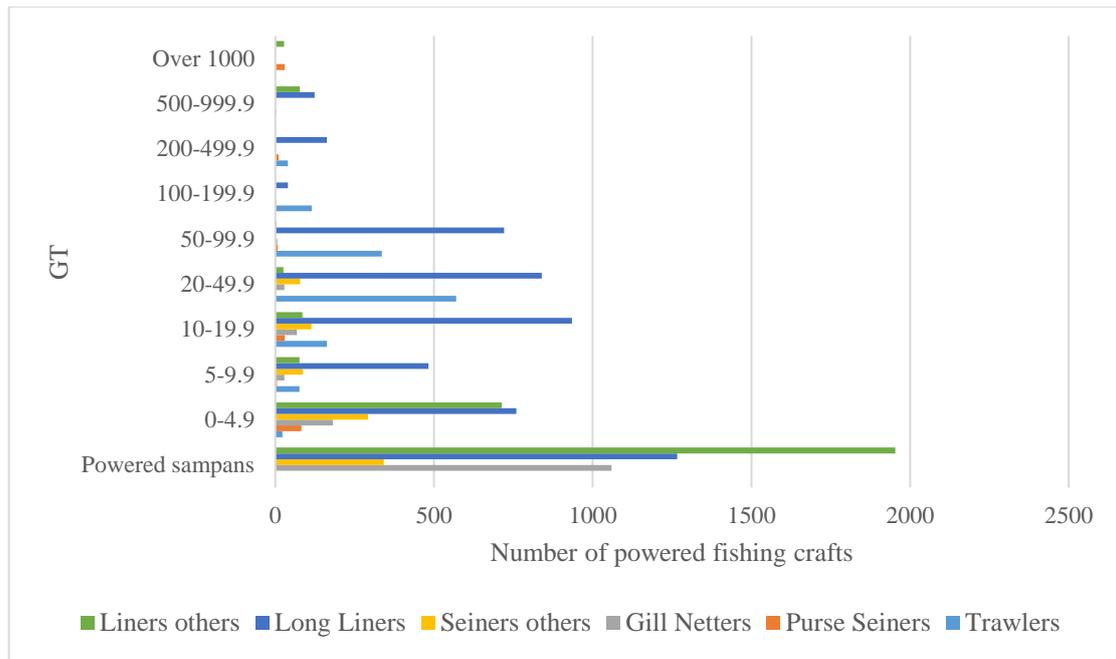


Figure 8. Number of each vessel type by GT category in 2020

3. Statistical analysis of marine accident occurrences

3.1 Marine casualty analysis of merchant vessels

A marine accident overview involving merchant vessels is first conducted in terms of casualty type, GT, vessel registration, ship age, ship type, and occurrence severity based on the data from Maritime and Port Bureau, MOTC. Pairwise comparisons between casualty type, severity, and each factor are subsequently initiated.

3.1.1 Overview of marine casualty involving merchant vessels

The data of marine casualties occurring between 2015 and 2020 has been classified in the aspects of GT, vessel registration, ship age, ship type, occurrence time (month), location, and severity, respectively. Table 9 and Figure 9 show the number of marine occurrences during the period. A dramatic rise takes place in 2016 and 2019. Table 10 and Figure 10 show the number of marine casualty occurrence by month. Resulting in northeast monsoons in January and December, and typhoons in August, September, and October, the monthly number of marine occurrences are all more than 60. February and May are less likely to occur marine accidents with percentages of 6.79 and 5.64. Table 11 and Figure 11 show the number of merchant vessels involved in casualty in terms of GT. Ships under 5,000 GT have the highest rate for marine occurrences, accounting for 47.69%. Followed by category of over 15,000 GT and 5,001-10,000 GT.

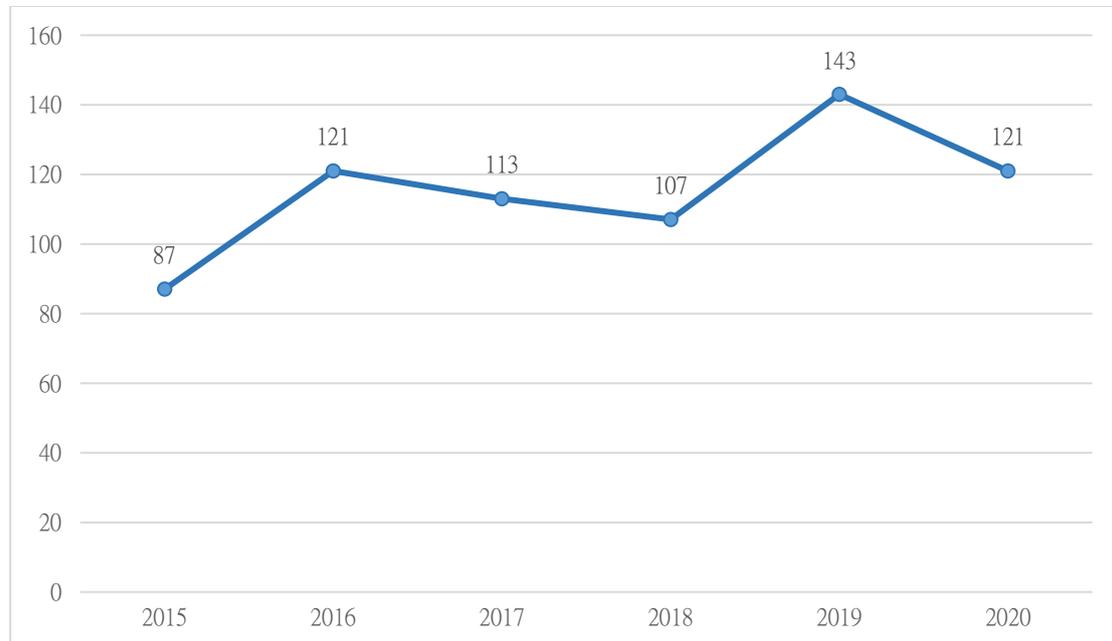
Figure 12 contains 4 water areas divided by four Maritime and Port Bureau agencies, namely, North, Central, South, and East Maritime Affairs Centers according to the jurisdictions. The figure also shows the Kinmen/Matsu waters. The five water areas along with other water area are adopted to classify the locations while marine casualties occurred.

Table 12 and Figure 13 express the number of shipping accidents in terms of locations. The water area under the jurisdiction of the South Maritime Affairs Center has the highest number (247) in marine casualty occurrence. Followed by North and Central Maritime Affairs Center (134) and East (45) Maritime Affairs Centers, respectively. The Kinmen/Matsu waters has the less number of marine accident occurrence (14).

Table 9. Number of marine occurrences involving merchant vessels 2015-2020

Year	2015	2016	2017	2018	2019	2020
Number	87	121	113	107	143	121

Source: Maritime and Port Bureau, MOTC (2021)



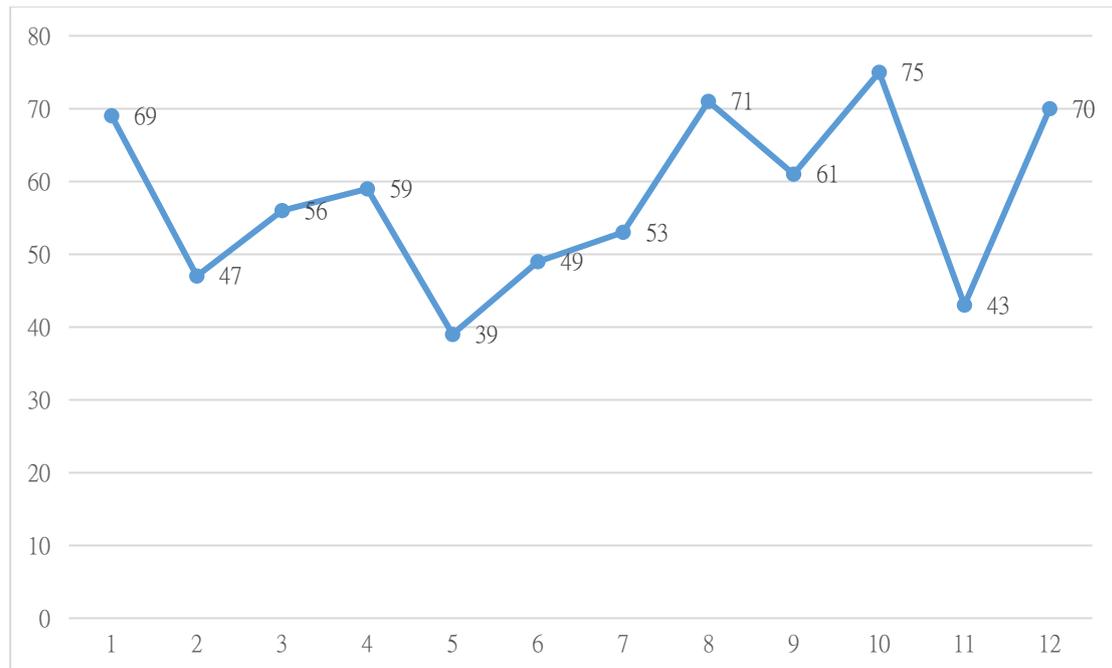
Source: Maritime and Port Bureau, MOTC (2021)

Figure 9. Number of marine occurrences involving merchant vessels 2015-2020

Table 10. Number of marine casualty occurrence by month 2015-2020

Month	Total	Percentage
1	69	9.97
2	47	6.79
3	56	8.09
4	59	8.53
5	39	5.64
6	49	7.08
7	53	7.66
8	71	10.26
9	61	8.82
10	75	10.84
11	43	6.21
12	70	10.12
Overall Total	692	100

Source: Maritime and Port Bureau, MOTC (2021)



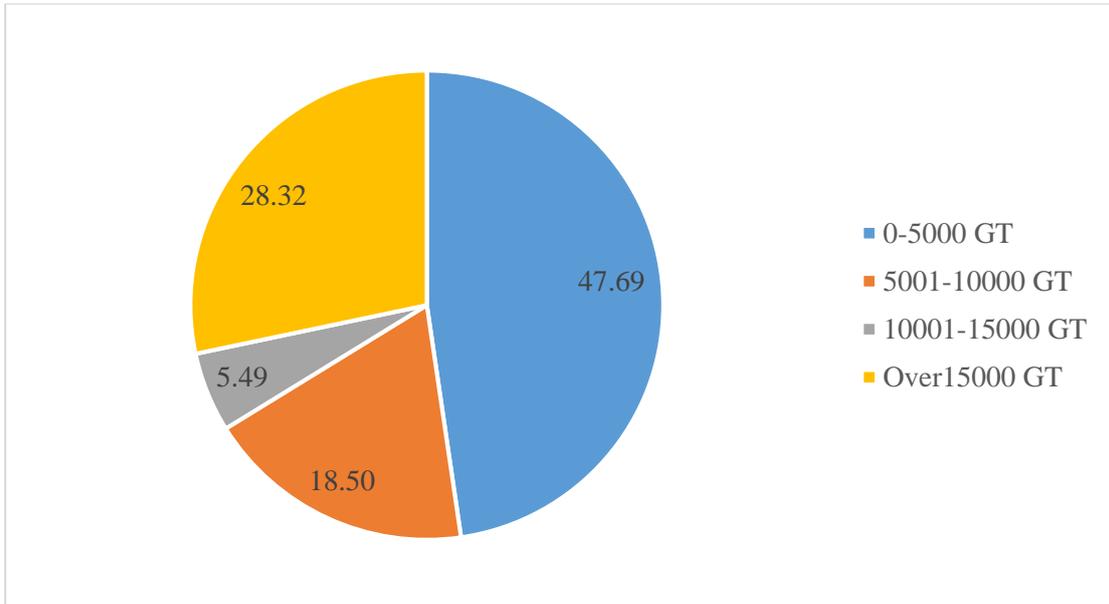
Source: Maritime and Port Bureau, MOTC (2021)

Figure 10. Number of marine casualty occurrence by month 2015-2020

Table 11. Number of merchant vessels in casualty by GT 2015-2020

GT	Total	Percentage
0-5,000	330	47.69
5,001-10,000	128	18.50
10,001-15,000	38	5.49
Over 15,000	196	28.32
Overall Total	692	100

Source: Maritime and Port Bureau, MOTC (2021)



Source: Maritime and Port Bureau, MOTC (2021)

Figure 11. Percentage of merchant vessels in casualty by GT 2015-2020



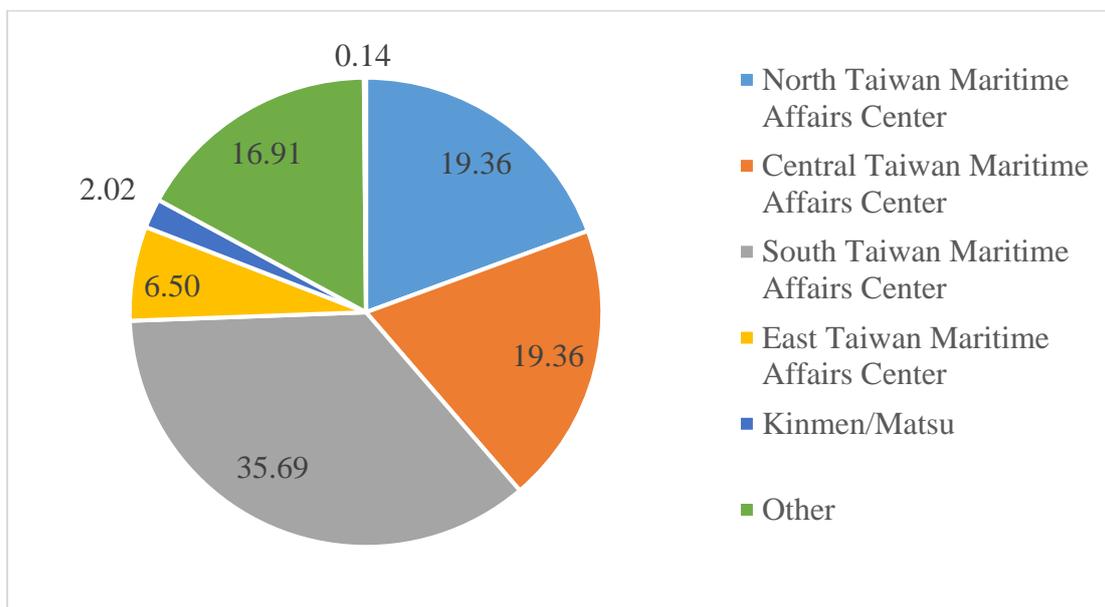
Source: Maritime and Port Bureau, MOTC

Figure 12. Accident site classification for marine casualty

Table 12. Number of shipping accident by locations 2015-2020

Location	Total	Percentage
North Taiwan Maritime Affairs Center	134	19.36
Central Taiwan Maritime Affairs Center	134	19.36
South Taiwan Maritime Affairs Center	247	35.69
East Taiwan Maritime Affairs Center	45	6.50
Kinmen/Matsu	14	2.02
Other	117	16.91
Unknown	1	0.14
Overall Total	692	100

Source: Maritime and Port Bureau, MOTC (2021)



Source: Maritime and Port Bureau, MOTC (2021)

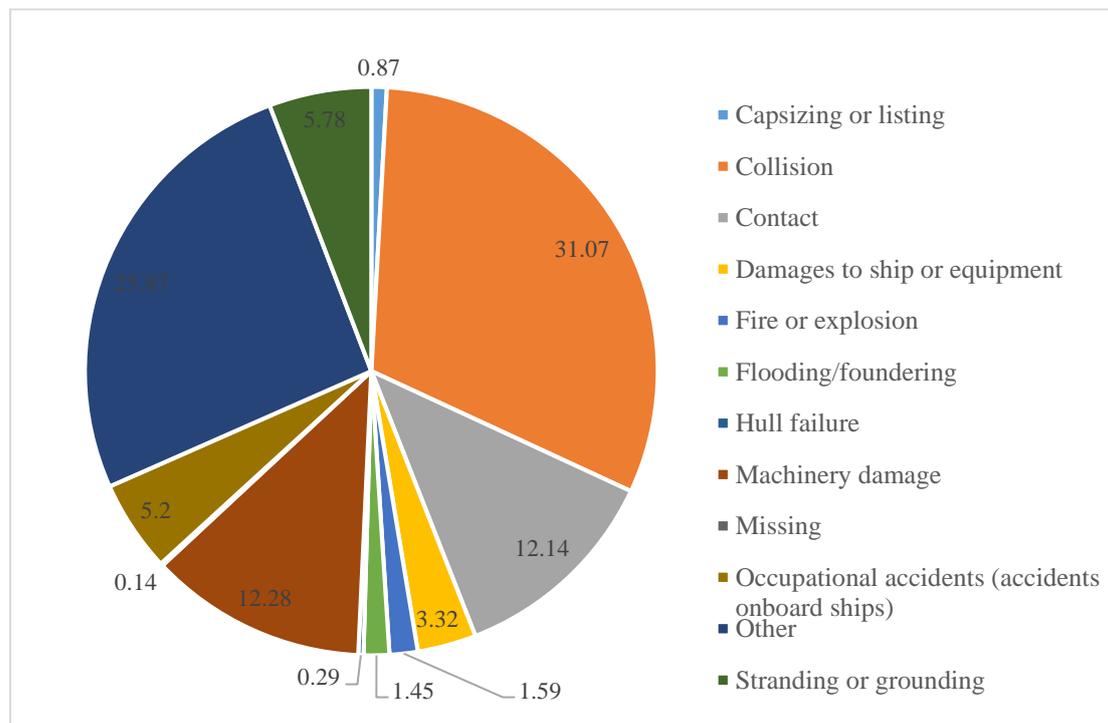
Figure 13. Percentage of shipping accident by locations 2015-2020

Table 13 and Figure 14 show the number and percentage of different accident type. Table 13 indicates that Collision is the most frequently occurring accident type among others, accounting for 31.07%, followed by Machinery Damage and Contact with the percentages of 12.28 and 12.14, respectively. In addition, Other, consisting of 25.87%, includes damage due to heavy weather, suicide, person missing, pollution, anchor chain losses, foul of propeller, etc.

Table 13. Number and percentage of each accident type 2015-2020

Type of casualty (initial event)	Total	Percentage
Capsizing or listing	6	0.87
Collision	215	31.07
Contact	84	12.14
Damages to ship or equipment	23	3.32
Fire or explosion	11	1.59
Flooding/foundering	10	1.45
Hull failure	2	0.29
Machinery damage	85	12.28
Missing	1	0.14
Occupational accidents (accidents onboard ships)	36	5.20
Other	179	25.87
Stranding or grounding	40	5.78
Overall Total	692	100

Source: Maritime and Port Bureau, MOTC (2021)



Source: Maritime and Port Bureau, MOTC (2021)

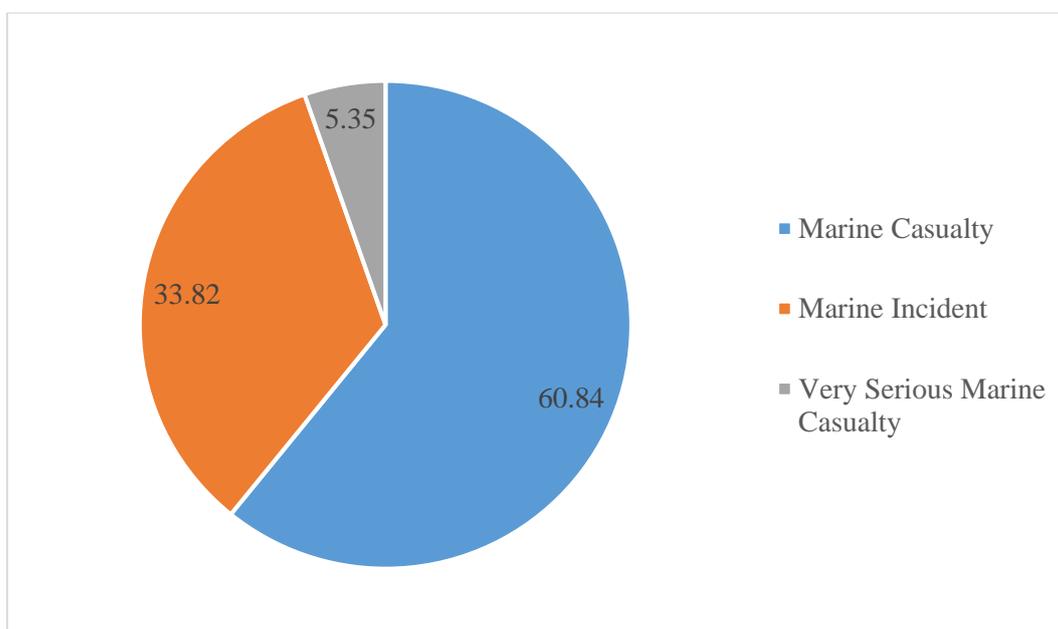
Figure 14. Percentage of each accident type 2015-2020

Table 14 and Figure 15 express the number of marine casualties in terms of severity. According to Table 14, most ship accidents belong to the Marine Casualty category, comprising 60.84%. Additionally, followed by the group of Marine Incident and Very Serious Marine Casualty with the percentages of 33.82 and 5.35 respectively.

Table 14. Number of marine casualty in terms of severity 2015-2020

Occurrence severity	Total	Percentage
Very Serious Marine Casualty	37	5.35
Marine Casualty	421	60.84
Marine Incident	234	33.82
Overall Total	692	100

Source: Maritime and Port Bureau, MOTC (2021)



Source: Maritime and Port Bureau, MOTC (2021)

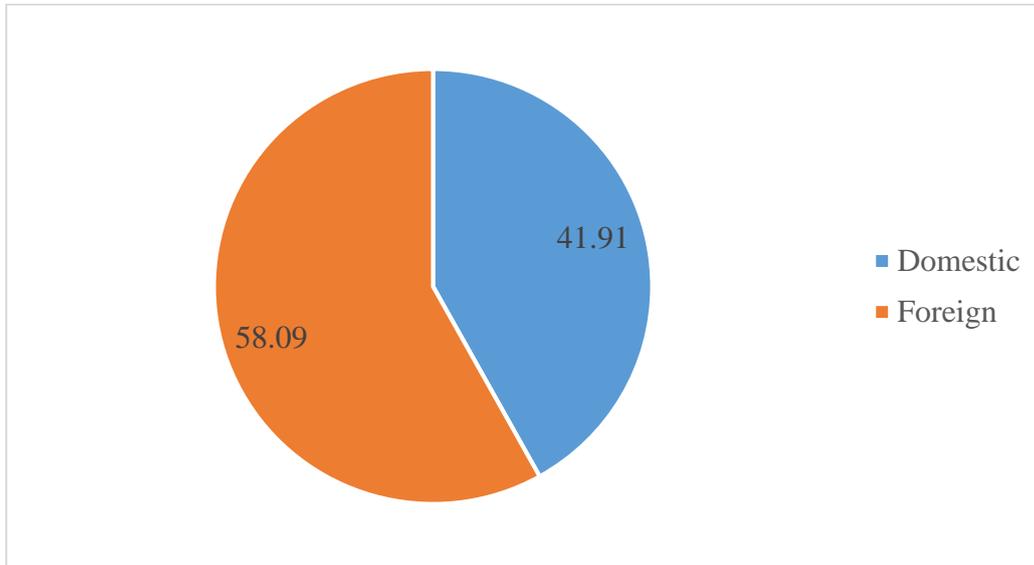
Figure 15. Percentage of marine casualties in terms of severity 2015-2020

Table 15 and Figure 16 show the number and percentage of marine casualties in terms of Domestic and Foreign categories. More than half of the disasters occurred in foreign vessels accounting for 58.09%. Table 16 and Figure 17 express the number and percentage of merchant vessels in casualty in terms of ship age. The ships in the over 15 group have the highest number in accident occurrence with a percentage of 45.95%. This is followed by 11-15, 6-10, and 0-5 age groups. Table 17 and Figure 18 show the number and percentage of marine casualties in terms of ship type. According to Table 17, the numbers and percentages of shipping accidents involving General Cargo, Container, Oil/Chemical Tanker, Bulk Carrier, Passenger, and Tug are higher than other ship types.

Table 15. Number and percentage of marine casualties in terms of Domestic and Foreign categories 2015-2020

Ship registration	Total	Percentage
Domestic	290	41.91
Foreign	402	58.09
Total	692	100

Source: Maritime and Port Bureau, MOTC (2021)



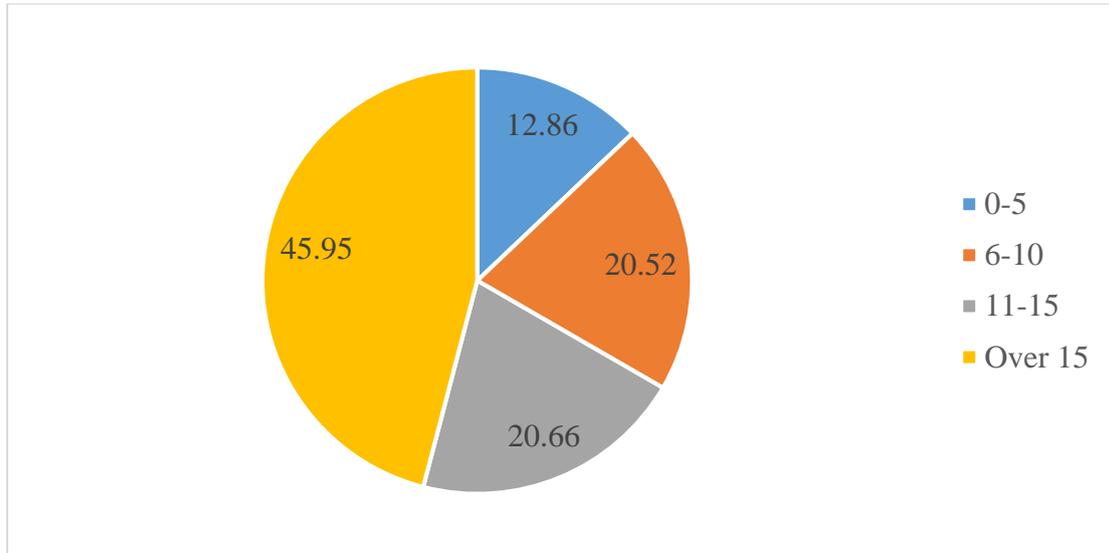
Source: Maritime and Port Bureau, MOTC (2021)

Figure 16. Percentage of marine casualties in terms of Domestic and Foreign categories 2015-2020

Table 16. Number and percentage of merchant vessels in casualty by ship age 2015-2020

Ship Age	Total	Percentage
0-5	89	12.86
6-10	142	20.52
11-15	143	20.66
Over 15	318	45.95
Overall Total	692	100

Source: Maritime and Port Bureau, MOTC (2021)



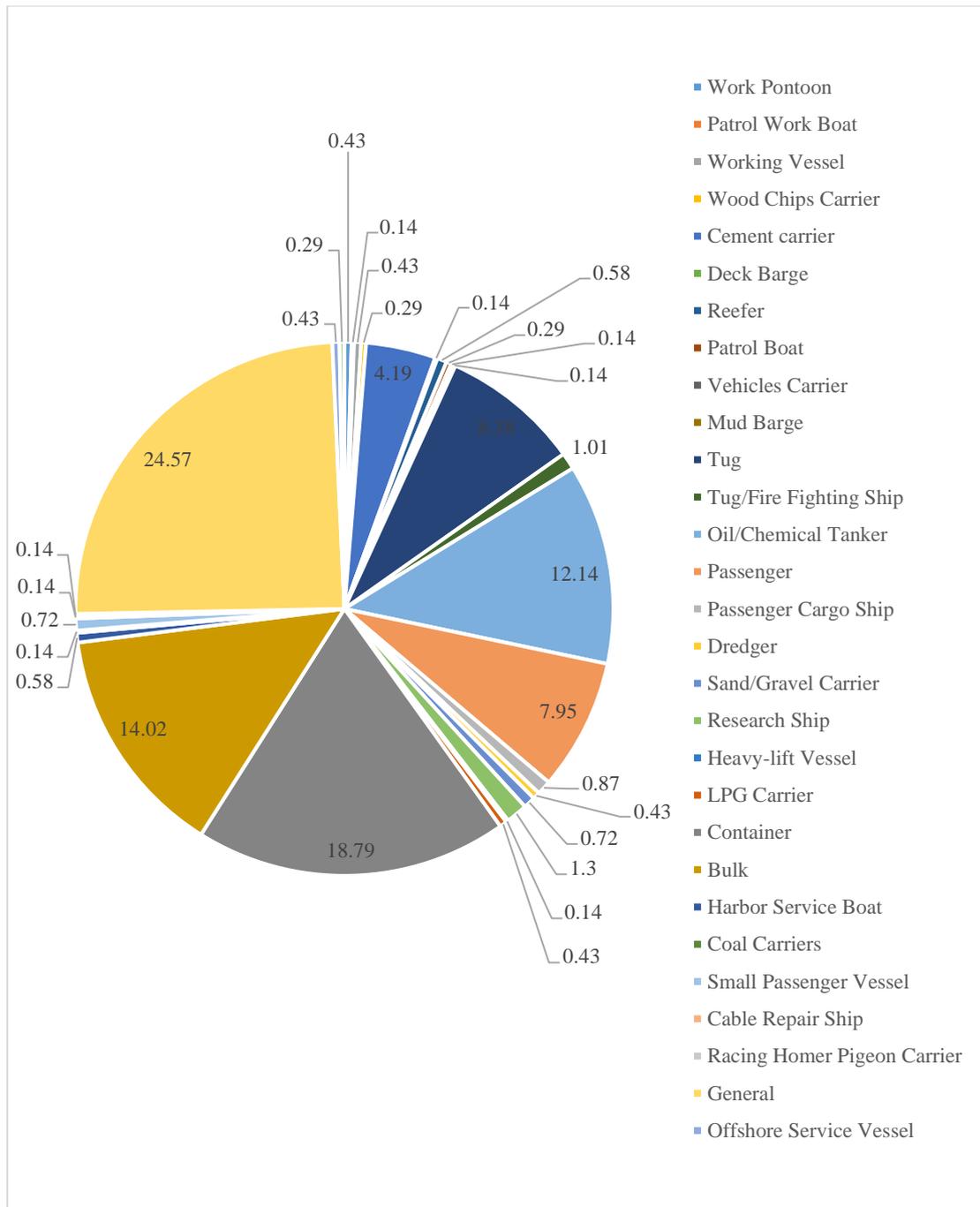
Source: Maritime and Port Bureau (MOTC, 2021)

Figure 17. Percentage of merchant vessels in casualty by ship age 2015-2020

Table 17. Number and percentage of marine casualties by ship type 2015-2020

Ship type	Total	Percentage
Work Pontoon	3	0.43
Patrol Work Boat	1	0.14
Working Vessel	3	0.43
Wood Chips Carrier	2	0.29
Cement carrier	29	4.19
Deck Barge	1	0.14
Reefer	4	0.58
Patrol Boat	2	0.29
Vehicles Carrier	1	0.14
Mud Barge	1	0.14
Tug	58	8.38
Tug/Fire Fighting Ship	7	1.01
Oil/Chemical Tanker	84	12.14
Passenger	55	7.95
Passenger Cargo Ship	6	0.87
Dredger	3	0.43
Sand/Gravel Carrier	5	0.72
Research Ship	9	1.30
Heavy-lift Vessel	1	0.14
LPG Carrier	3	0.43
Container	130	18.79
Bulk	97	14.02
Harbor Service Boat	4	0.58
Coal Carriers	1	0.14
Small Passenger Vessel	5	0.72
Cable Repair Ship	1	0.14
Racing Homer Pigeon Carrier	1	0.14
General	170	24.57
Offshore Service Vessel	3	0.43
naval vessel	2	0.29
Overall Total	692	100

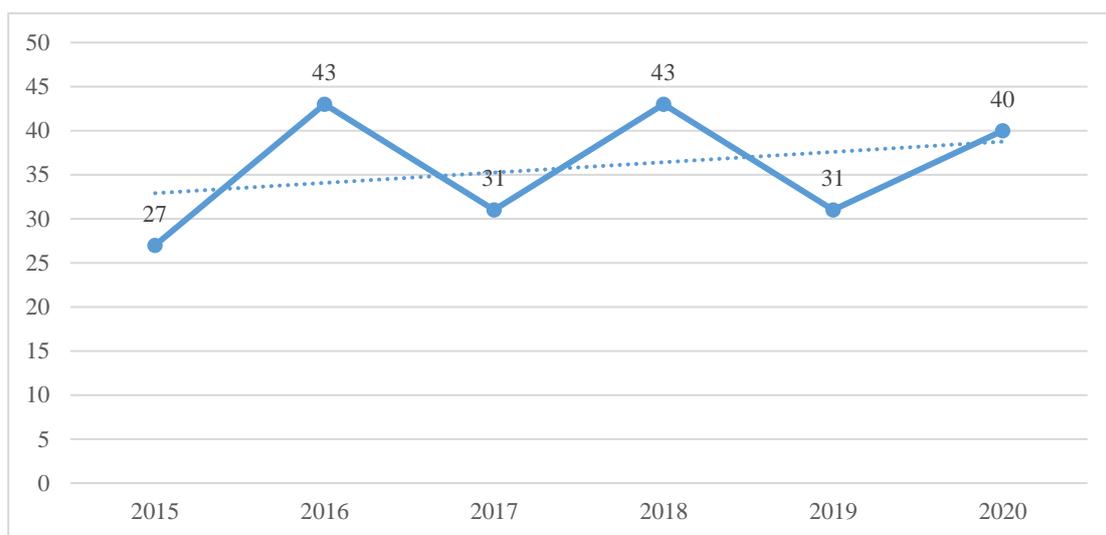
Source: Maritime and Port Bureau, MOTC (2021)



Source: Maritime and Port Bureau, MOTC (2021)

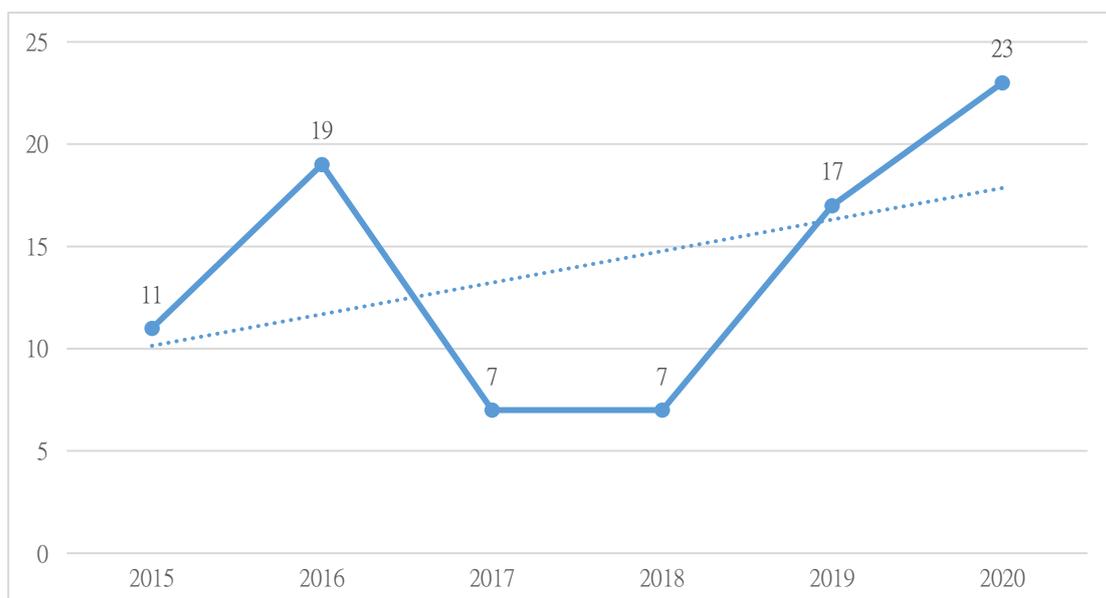
Figure 18. Percentage of marine casualties by ship type 2015-2020

The information in Figure 19 to Figure 29 shows the annual trend analysis of Collision, Contact, Machinery damage, Stranding or grounding, Occupational accidents, Damages to ship or equipment, Flooding/foundering, Fire or explosion, Hull failure, Capsizing or listing and Missing involving merchant ships from 2015 to 2020. Apart from Hull failure, and Missing, the annual frequencies of Collision, Machinery damage, Stranding or grounding, Occupational accidents, Contact, Damages to ship or equipment, Flooding/foundering, Fire or explosion, Capsizing or listing show an increasing trend.



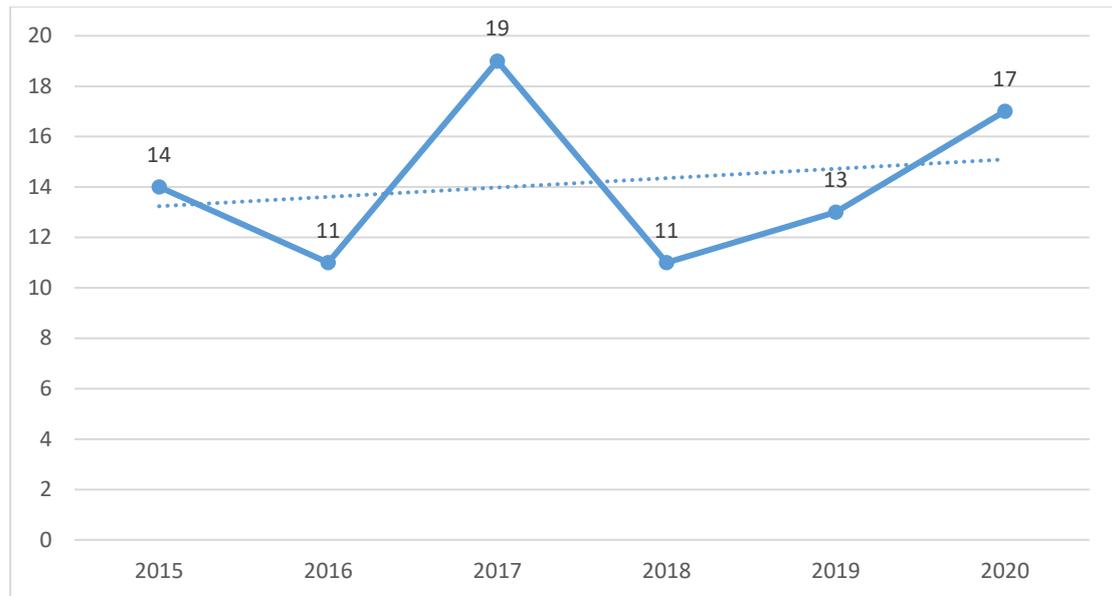
Source: Maritime and Port Bureau, MOTC (2021)

Figure 19. Annual trend analysis of merchant vessel collision 2015-2020



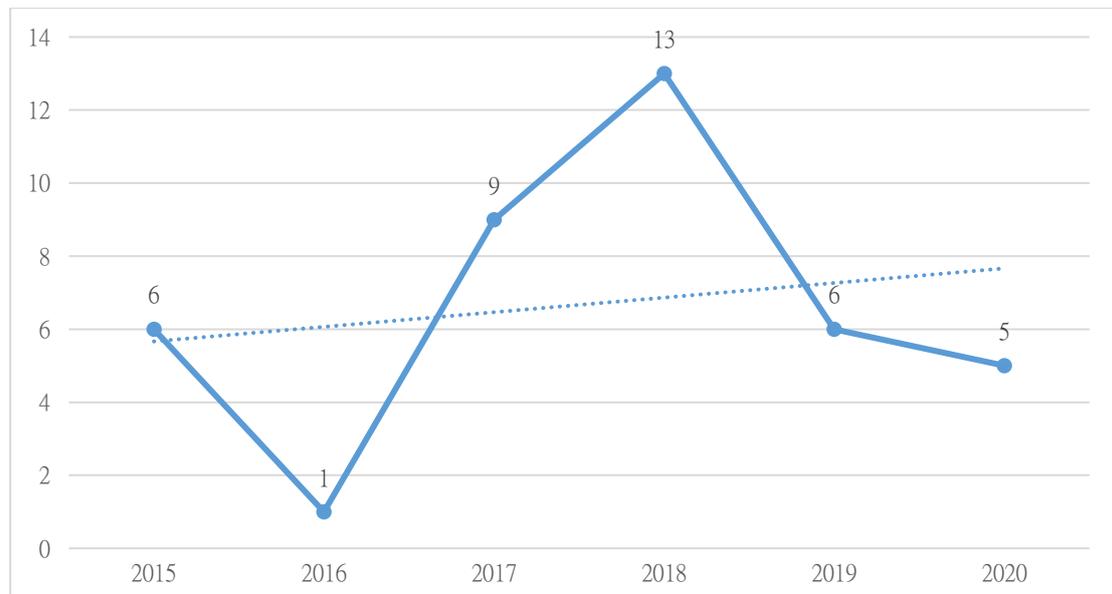
Source: Maritime and Port Bureau, MOTC (2021)

Figure 20. Annual trend analysis of merchant vessel contacts 2015-2020



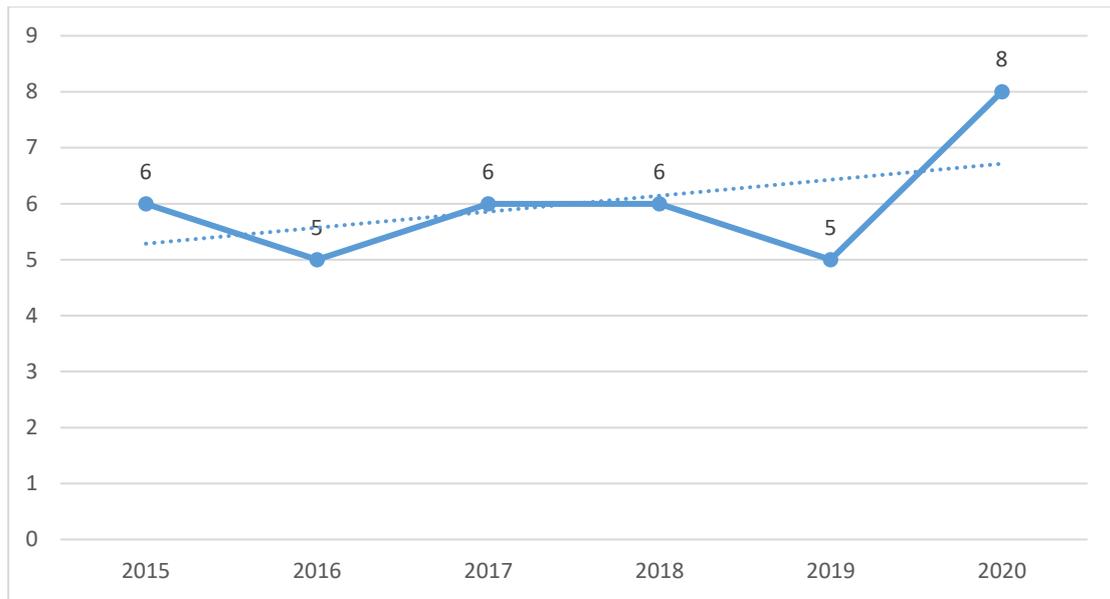
Source: Maritime and Port Bureau, MOTC (2021)

Figure 21. Annual trend analysis of merchant vessel machinery damage 2015-2020



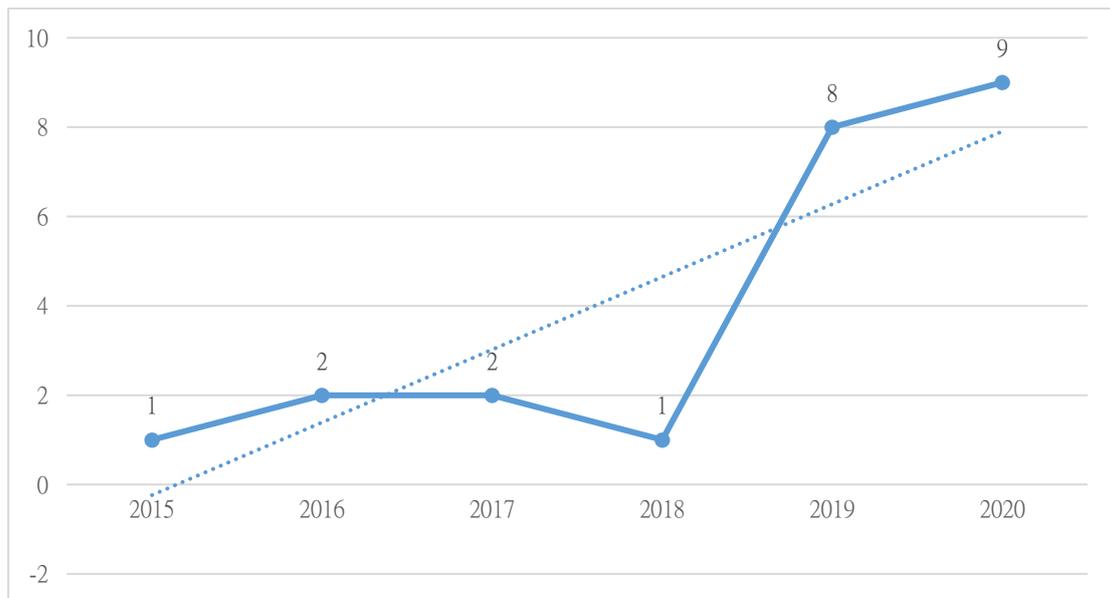
Source: Maritime and Port Bureau, MOTC (2021)

Figure 22. Annual trend analysis of merchant vessel stranding or grounding 2015-2020



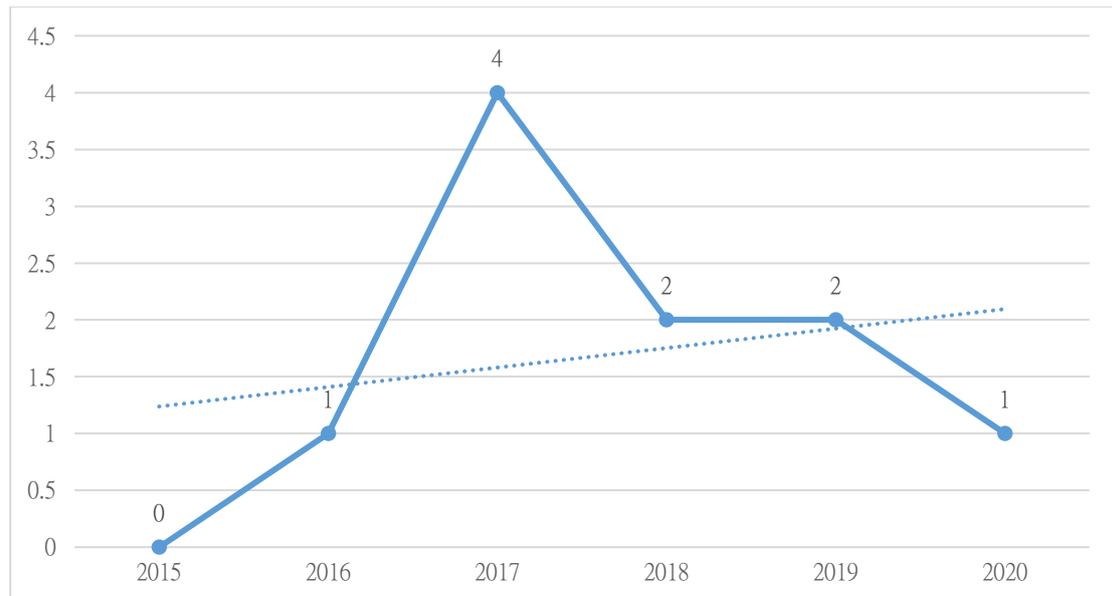
Source: Maritime and Port Bureau, MOTC (2021)

Figure 23. Annual trend analysis of merchant vessel occupational accidents (accidents on-board ships) 2015-2020



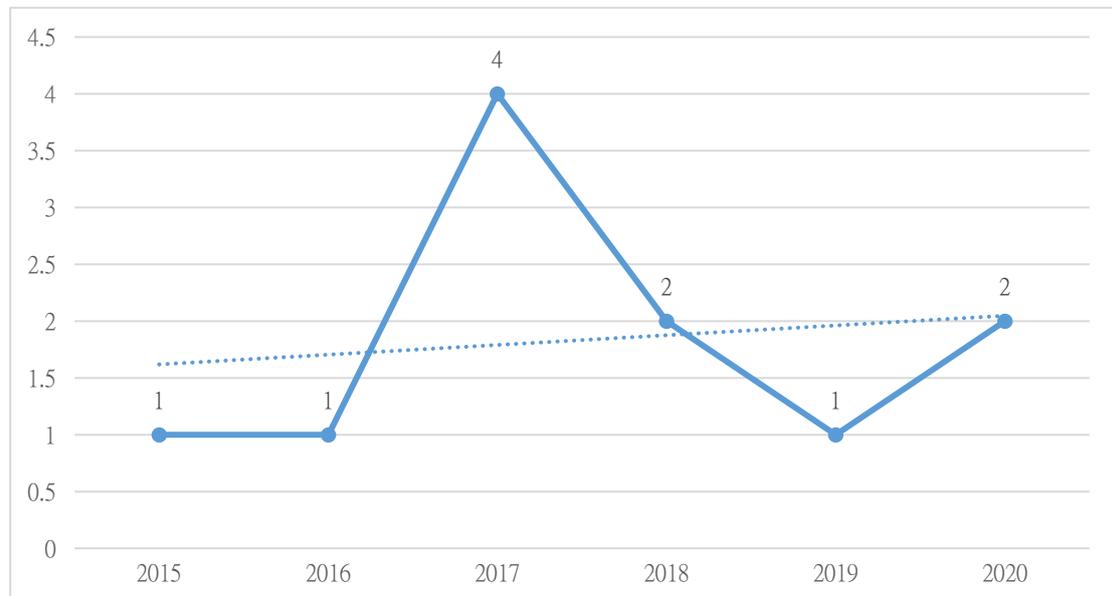
Source: Maritime and Port Bureau, MOTC (2021)

Figure 24. Annual trend analysis of merchant vessel damages to ship or equipment 2015-2020



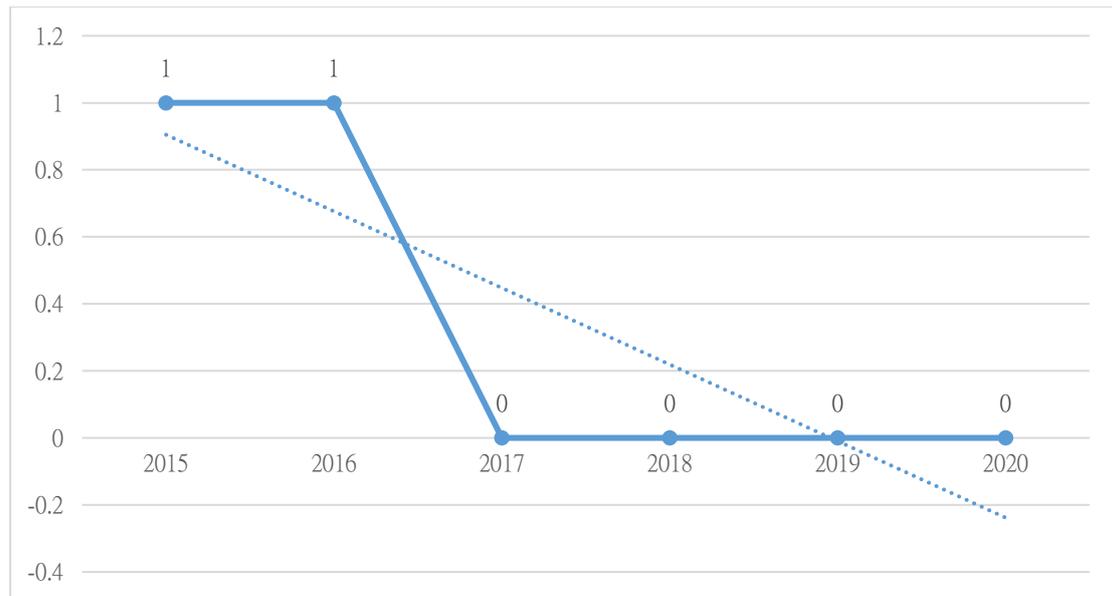
Source: Maritime and Port Bureau, MOTC (2021)

Figure 25. Annual trend analysis of merchant vessel flooding/fouling 2015-2020



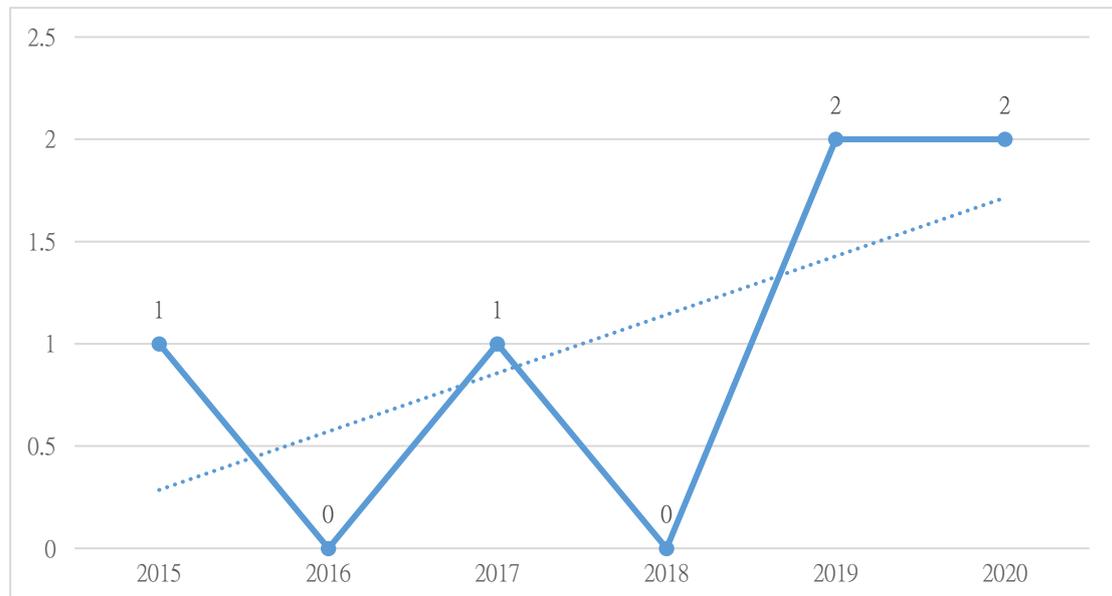
Source: Maritime and Port Bureau, MOTC (2021)

Figure 26. Annual trend analysis of merchant vessel fire or explosion 2015-2020



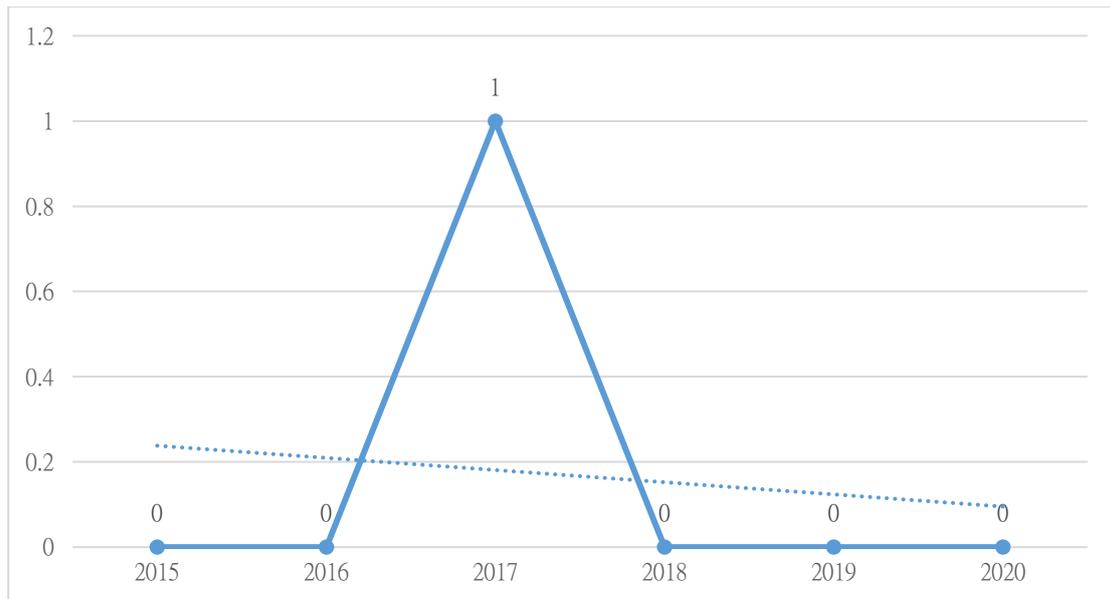
Source: Maritime and Port Bureau, MOTC (2021)

Figure 27. Annual trend analysis of merchant vessel hull failure 2015-2020



Source: Maritime and Port Bureau, MOTC (2021)

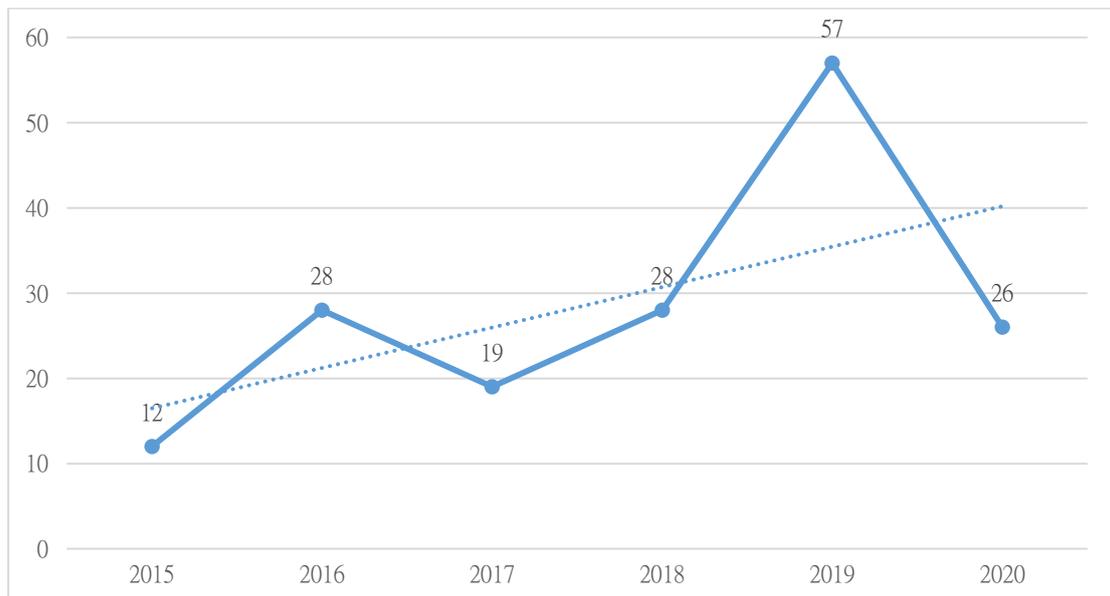
Figure 28. Annual trend analysis of merchant vessel capsizing or listing 2015-2020



Source: Maritime and Port Bureau, MOTC (2021)

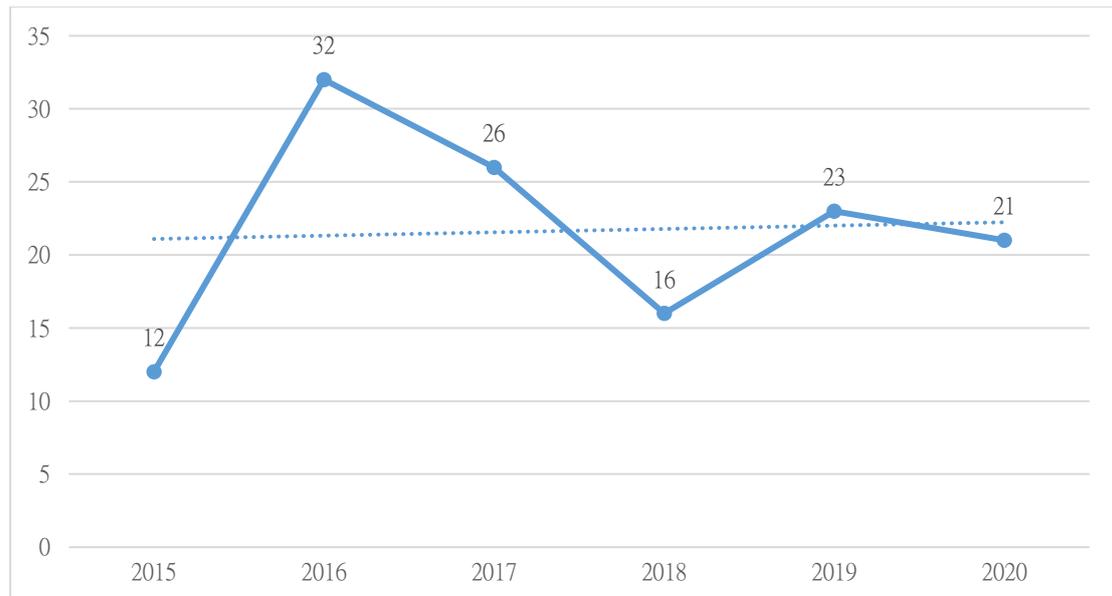
Figure 29. Annual trend analysis of merchant vessel missing 2015-2020

The annual trend analysis of marine casualties involving General, Container, Bulk, Oil/chemical tanker, Passenger, Tug, and Cement carrier between 2015 and 2020 is listed in Figure 30, Figure 31, Figure 32, Figure 33, Figure 34, Figure 35, and Figure 36, respectively. Shipping accidents involving General, Container, Passenger, and Cement carrier show a climbing trend whereas those involving Bulk carrier, Oil/chemical tanker, and Tug express a slight decline tendency.



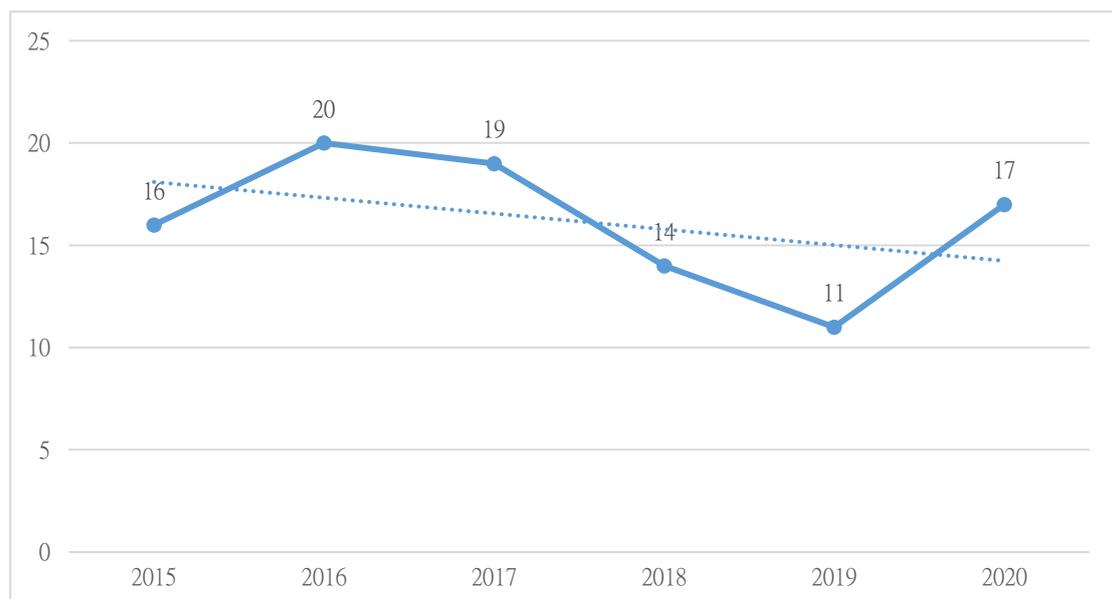
Source: Maritime and Port Bureau, MOTC (2021)

Figure 30. Annual trend analysis of marine occurrences involving general carrier 2015-2020



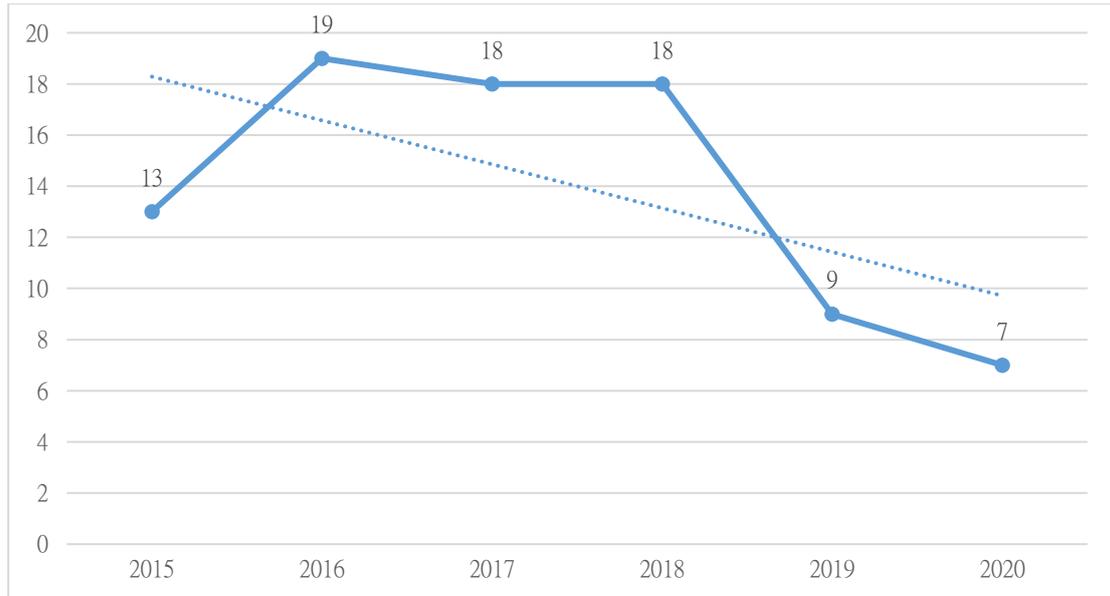
Source: Maritime and Port Bureau, MOTC (2021)

Figure 31. Annual trend analysis of marine occurrences involving container 2015-2020



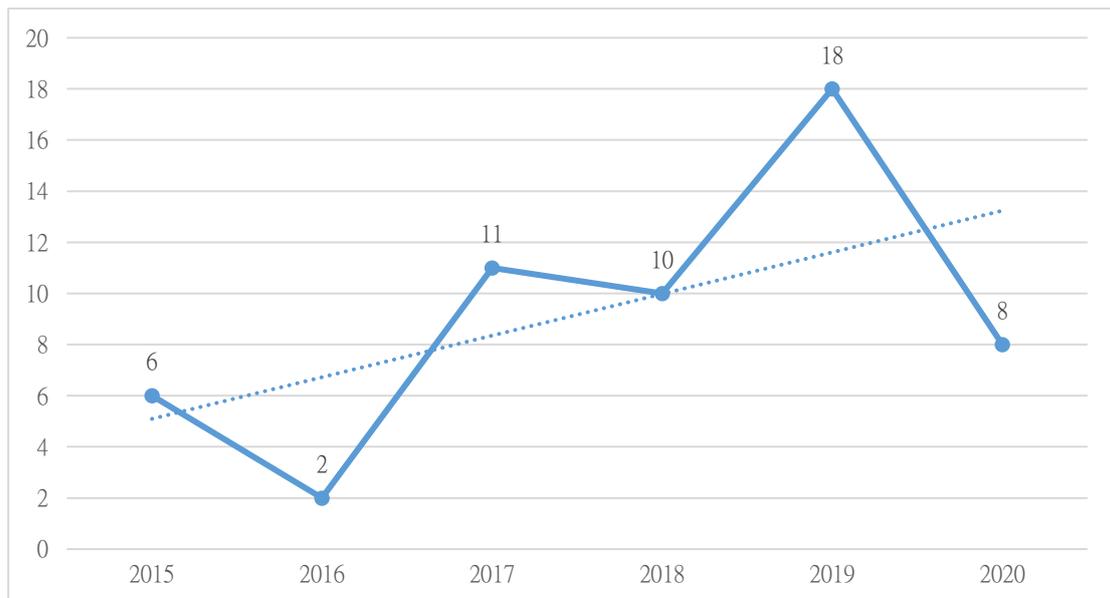
Source: Maritime and Port Bureau, MOTC (2021)

Figure 32. Annual trend analysis of marine occurrences involving bulk carrier 2015-2020



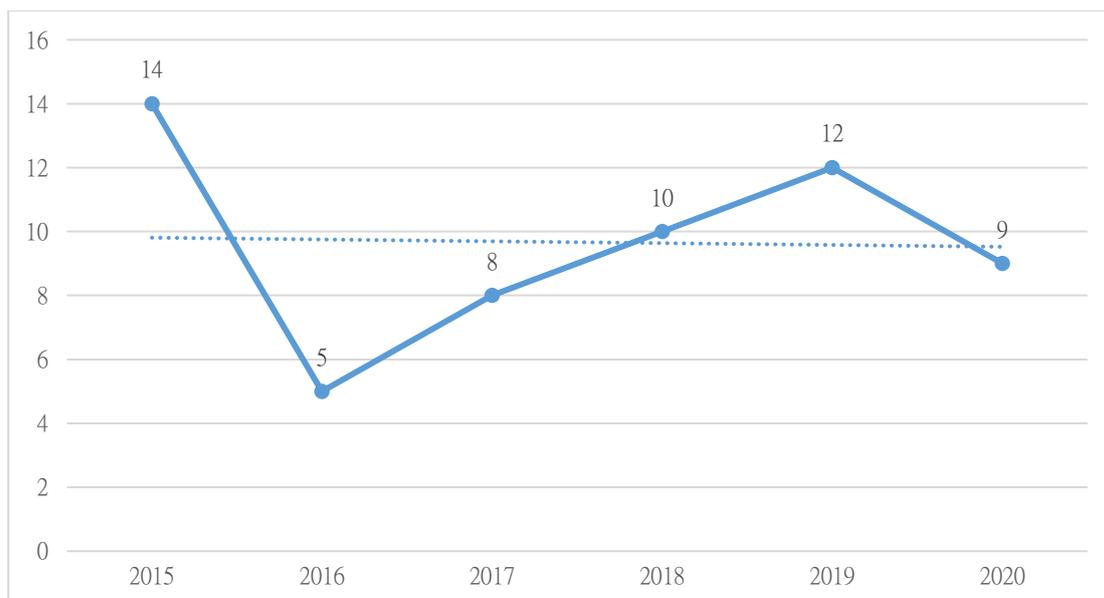
Source: Maritime and Port Bureau, MOTC (2021)

Figure 33. Annual trend analysis of marine occurrences involving oil/chemical tanker 2015-2020



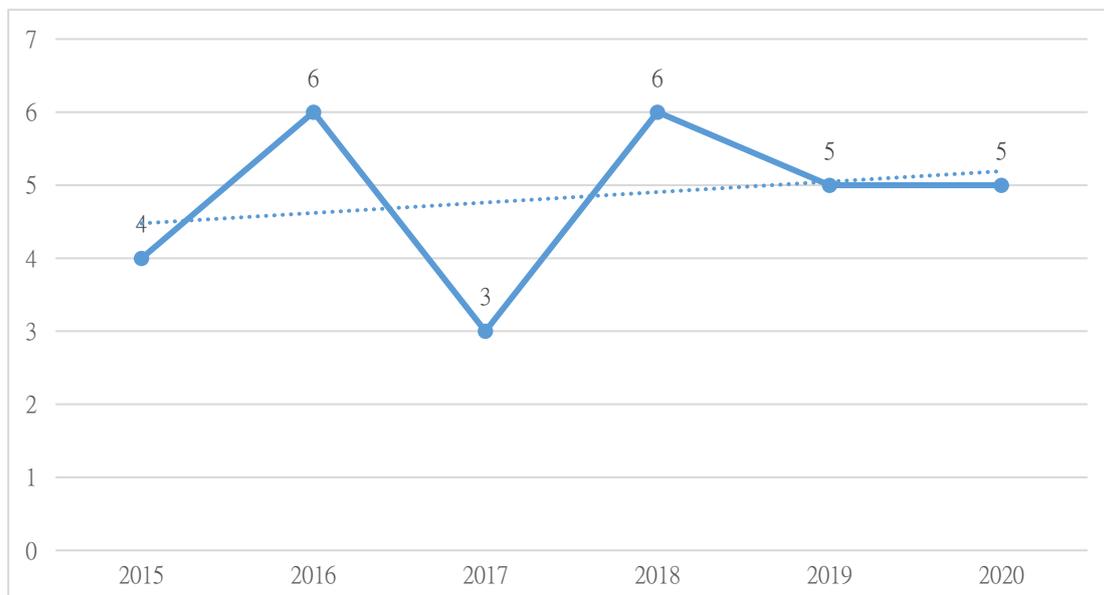
Source: Maritime and Port Bureau, MOTC (2021)

Figure 34. Annual trend analysis of marine occurrences involving passenger ship 2015-2020



Source: Maritime and Port Bureau, MOTC (2021)

Figure 35. Annual trend analysis of marine occurrences involving tug 2015-2020



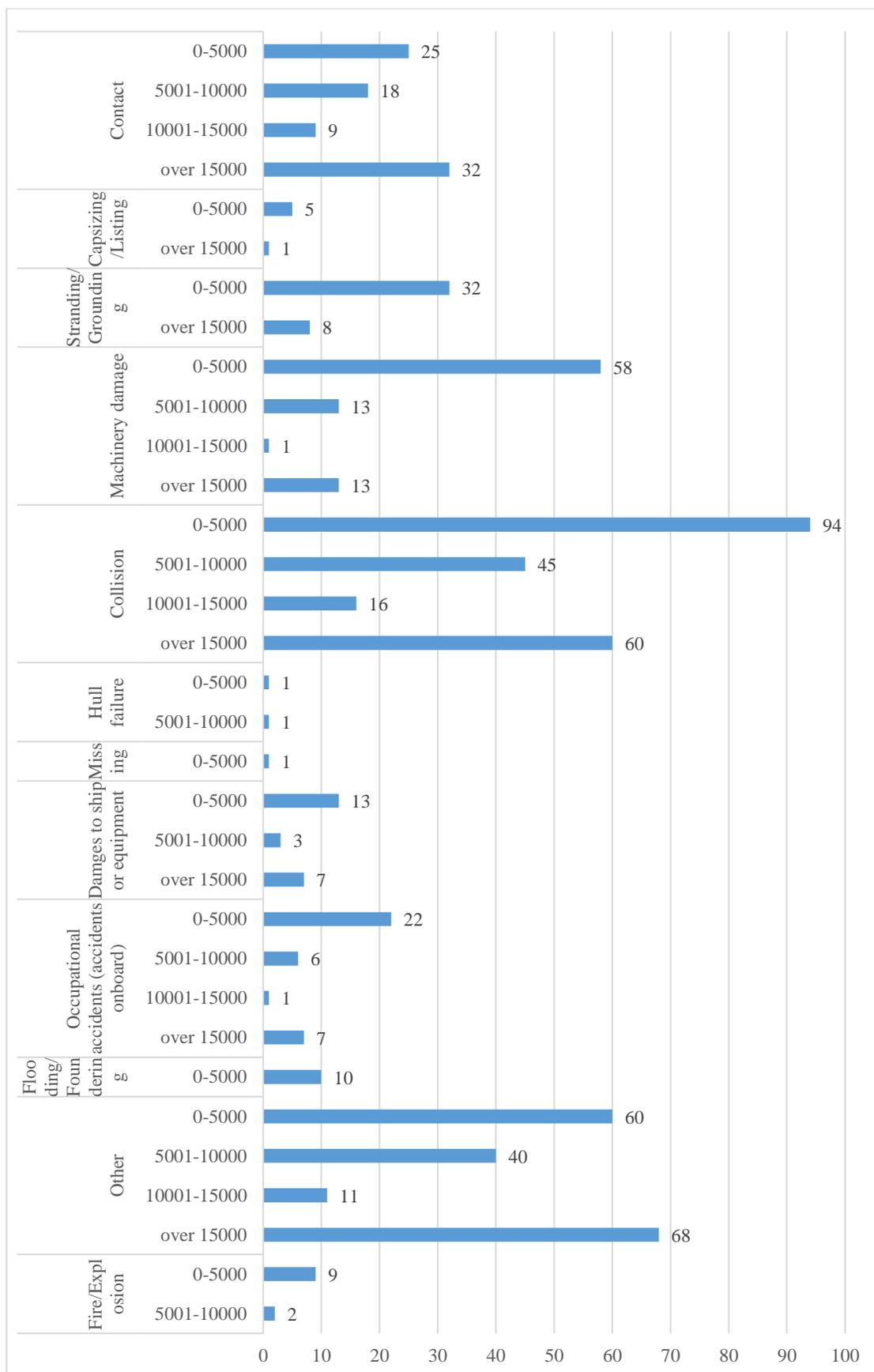
Source: Maritime and Port Bureau, MOTC (2021)

Figure 36. Annual trend analysis of marine occurrences involving cement carrier 2015-2020

3.1.2 Pairwise comparisons between elements for merchant vessel casualties

Figure 37 contains the pairwise comparisons between GT and casualty type. Figure 37 indicates that ships under 5000 GT or over 15000 GT tend to encounter Collision, Other and Contact. Ships under 5000 GT also are likely to confront with Machinery damage. It is also noted that ships under 5000 GT play certain roles in each casualty category. Vessels in Over 15000 GT category are likely to encounter Collision, Other, and Contact of which the occurrences are all over 30. Other and Collision tend

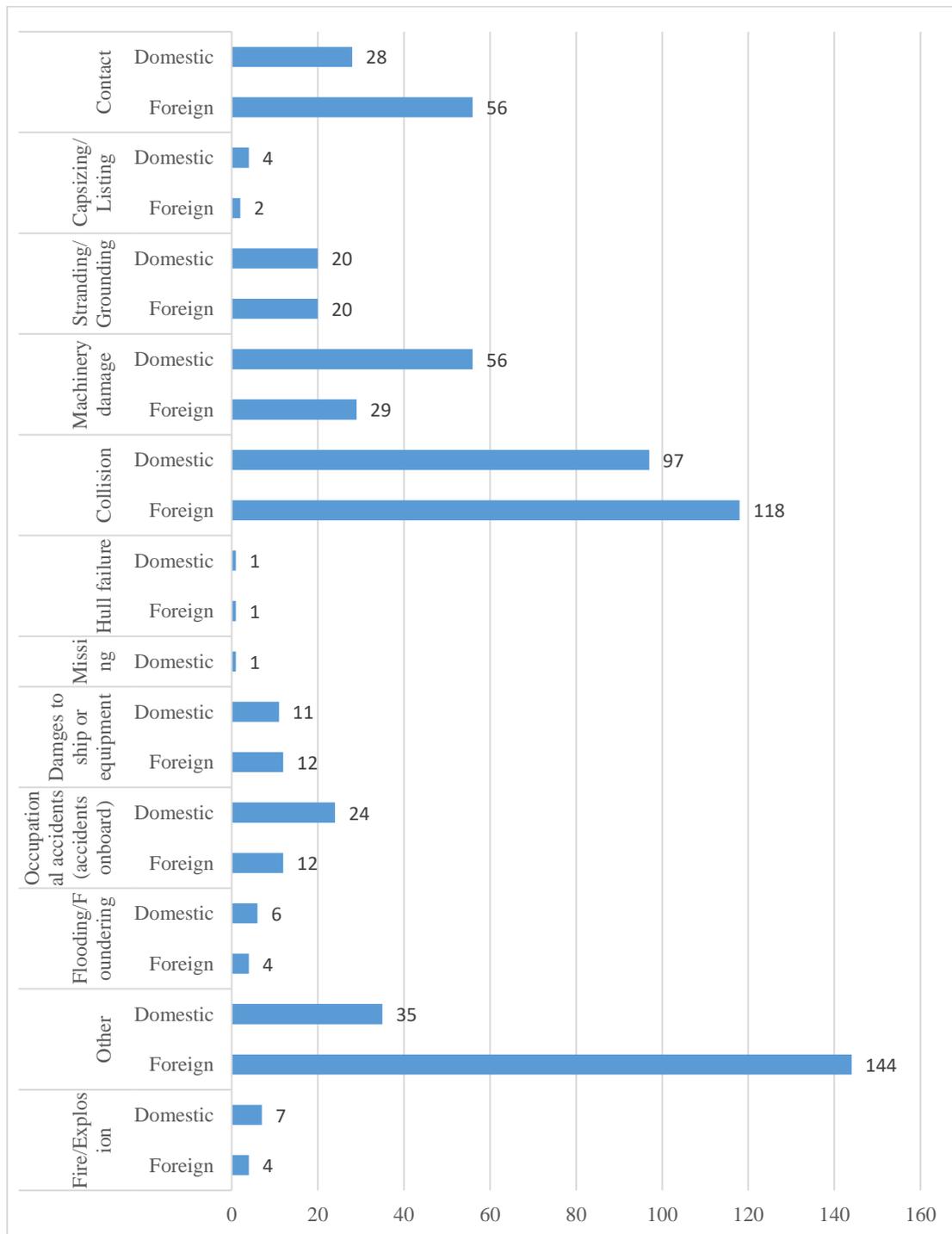
to take place in the 5001-10000 GT group, whereas the most frequently occurring accident types for under 5000 GT category in descending order were Collision, Other, Machinery damage, and Stranding or grounding, the number of accidents in each category were all over 30.



Source: Maritime and Port Bureau, MOTC (2021)

Figure 37. Pairwise comparisons between GT and casualty type 2015-2020

Figure 38 is the pairwise comparison between casualty type and vessel registration. According to the figure, Foreign vessels frequently encounter the accident of Other, Collision, and Contact. Taiwanese merchant vessels, on the other hand, are likely to confront with Machinery damage and Occupational accidents.

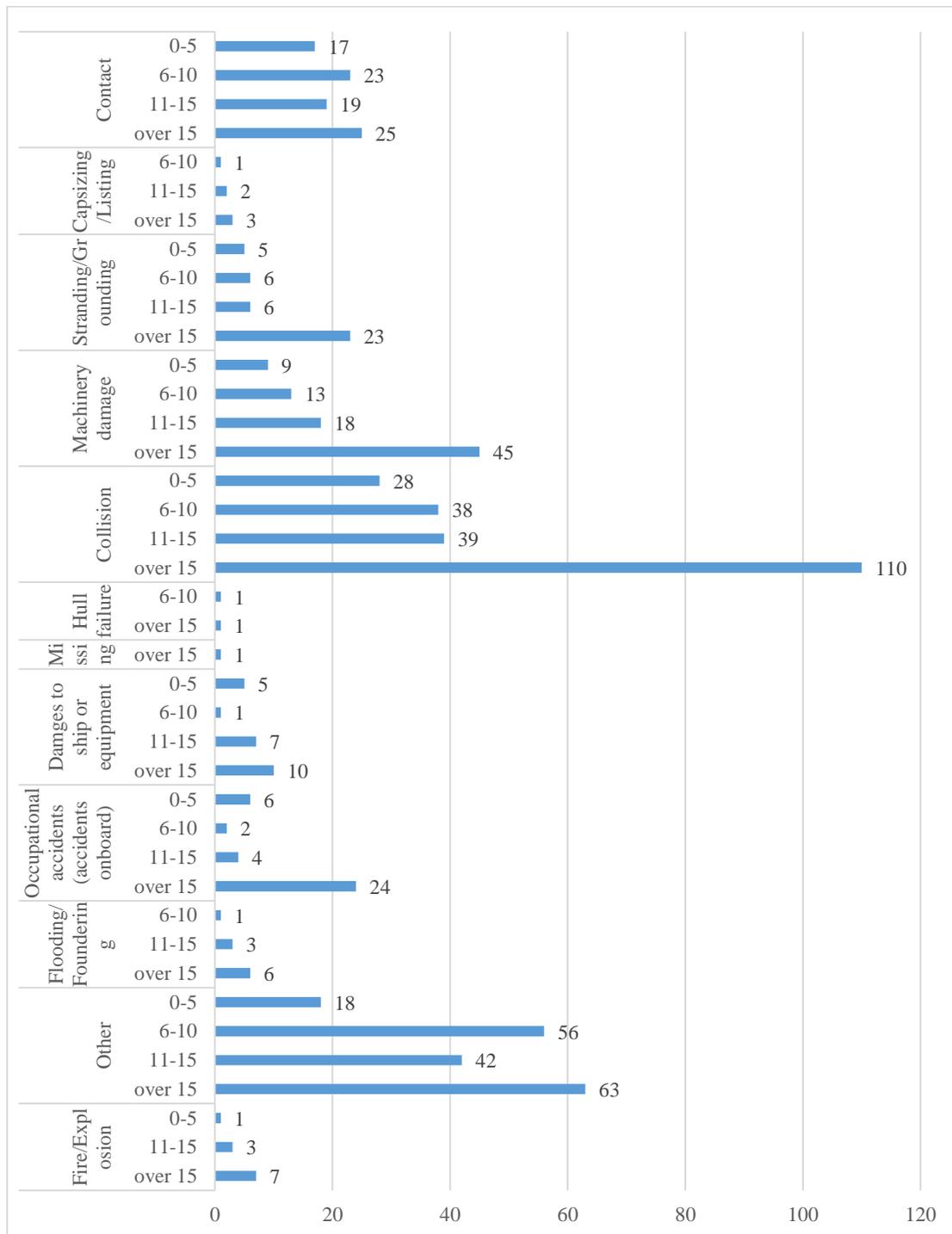


Source: Maritime and Port Bureau, MOTC (2021)

Figure 38. Pairwise comparisons between casualty type and flag 2015-2020

Figure 39 shows the pairwise comparisons between casualty and ship age. Ships

over 15 years old tend to suffer from Collision, Other, Machinery damage, Damages to ship or equipment, Fire/Explosion, Stranding or grounding, and Occupational accidents. Ships with the age between 6 to 15 are likely to encounter Other and Collision.

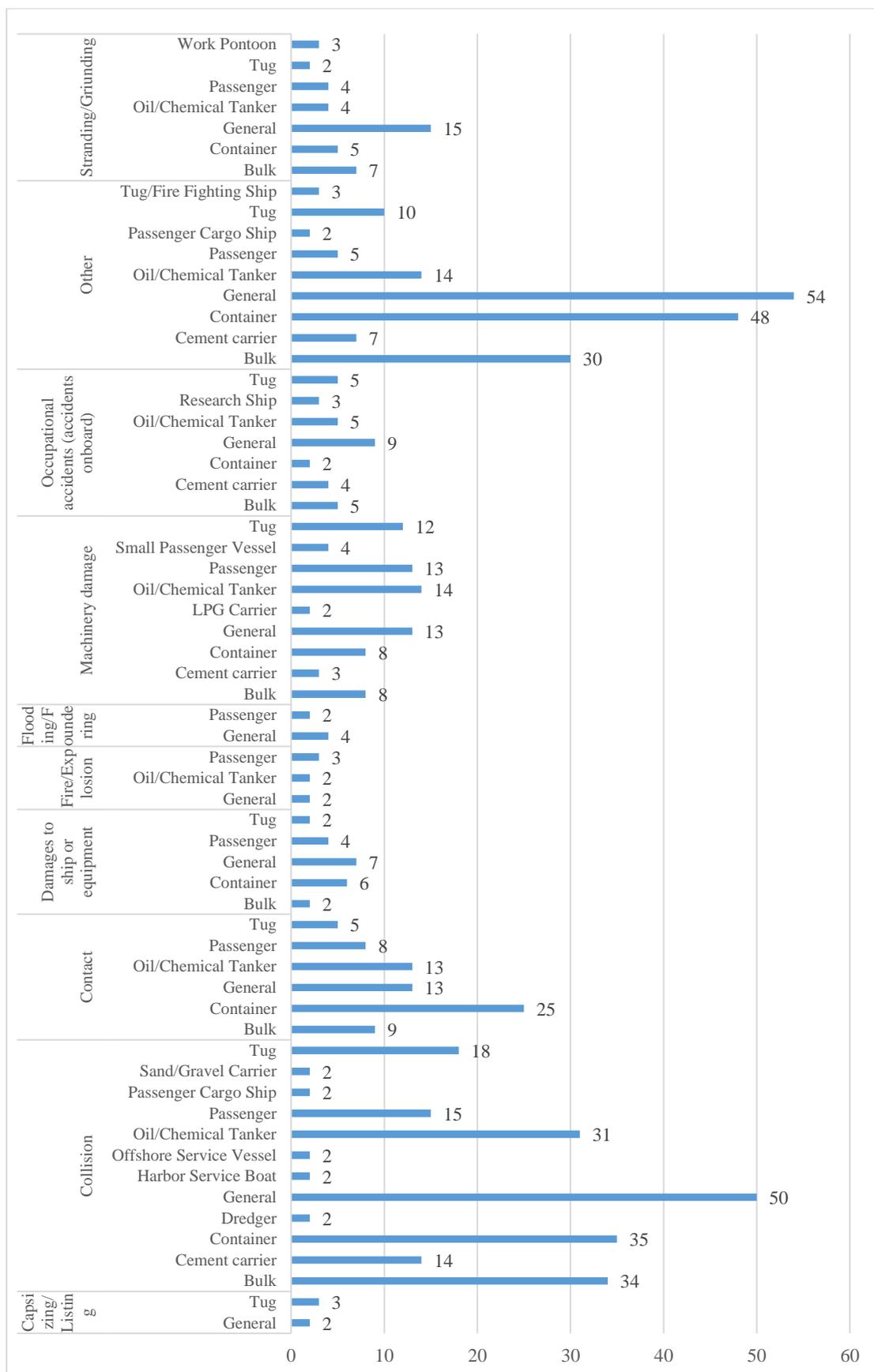


Source: Maritime and Port Bureau, MOTC (2021)

Figure 39. Pairwise comparisons between casualty type and ship age 2015-2020

Figure 40 is the pairwise comparison between casualty type and ship type¹. The figure indicates that Container is the ship type that encounters Contact (21 cases) most frequently, followed by General (13 cases) and Oil/Chemical Tanker (13 cases). General (15 cases) and Bulk Carrier (7 cases) are the vessel groups that are likely to confront with Stranding or grounding. General (50 cases), Container (35 cases), Bulk (34 cases), and Oil/Chemical Tanker (31 cases), and General are frequently involved in Collision.

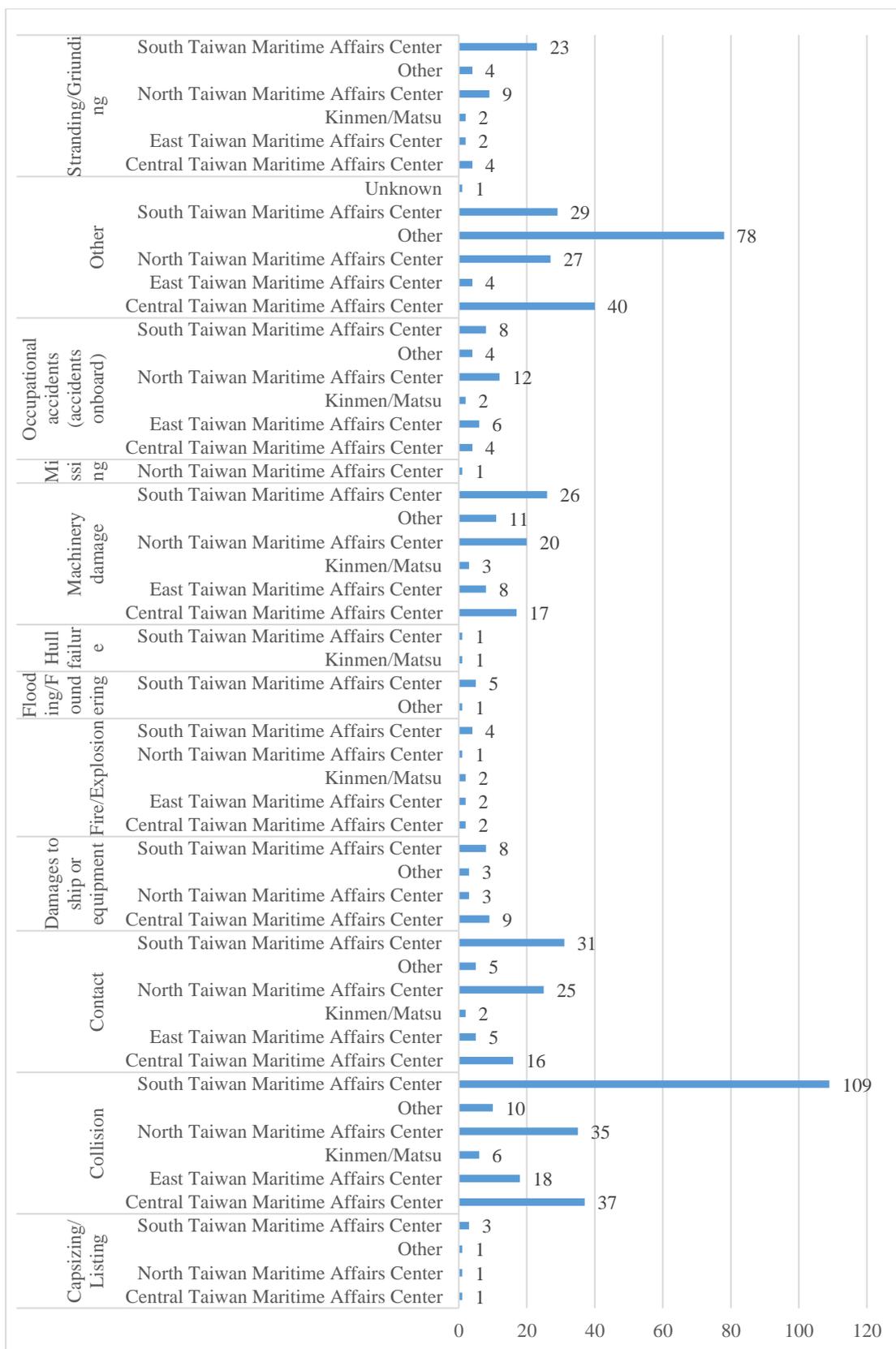
¹ It is noted that there are some other types of vessels involved in marine casualties, including cable laying vessels, car carriers, barges, etc. Due to the fact that the number of occurrences of such vessels is only 1.



Source: Maritime and Port Bureau, MOTC (2021)

Figure 40. Pairwise comparisons between casualty and ship type 2015-2020

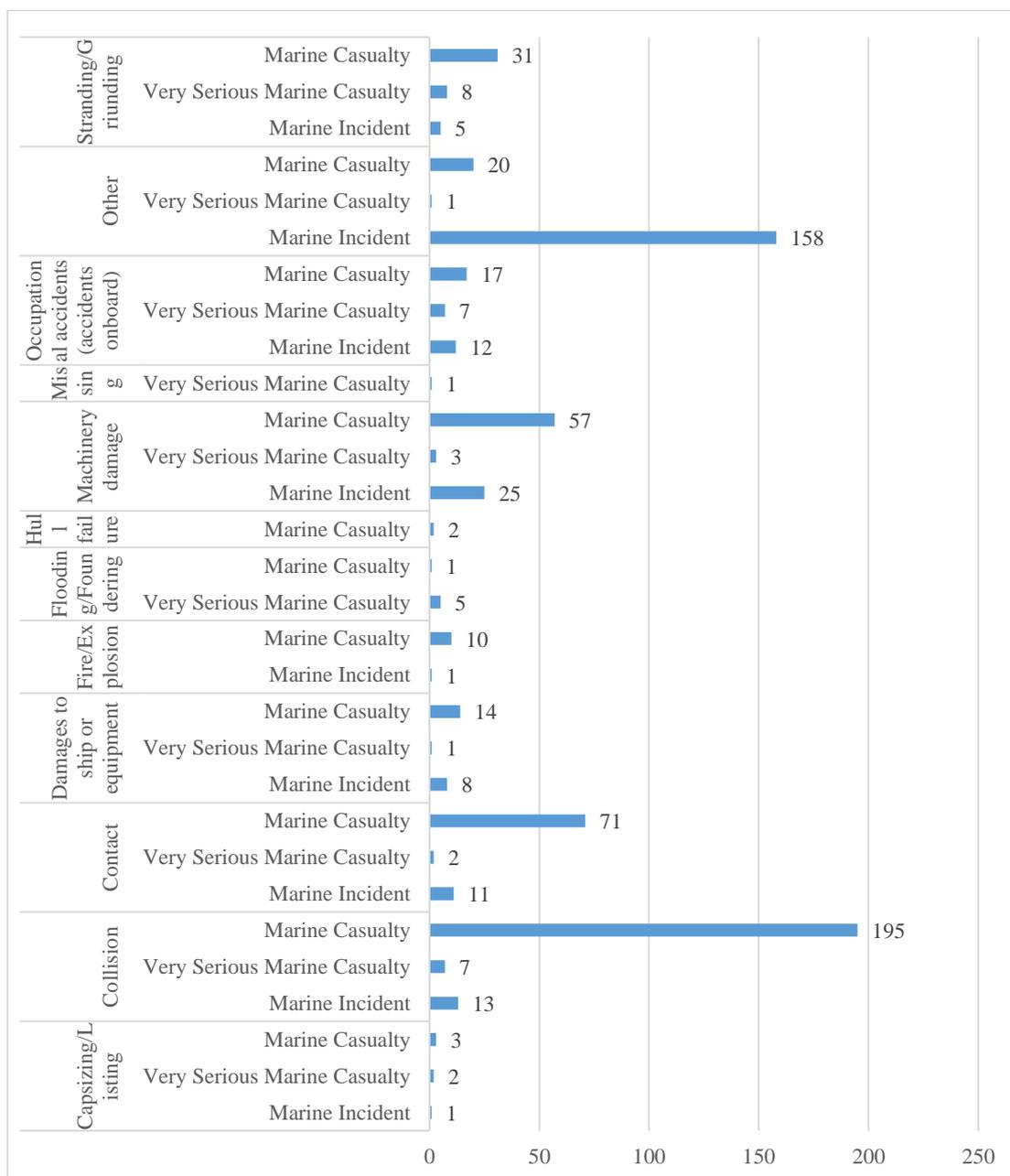
Figure 41 contains the pairwise comparisons between casualty type and locations. Contact, Capsizing or listing, Stranding or grounding, Collision, Machinery damage, Flooding/Foundering, and Fire/Explosion often take place under the jurisdiction of the South Taiwan Maritime Affairs Center. Occupational accidents are likely to occur in the waters under the supervision of North Taiwan Maritime Affairs Center.



Source: Maritime and Port Bureau, MOTC (2021)

Figure 41. Pairwise comparisons between casualty type and location 2015-2020

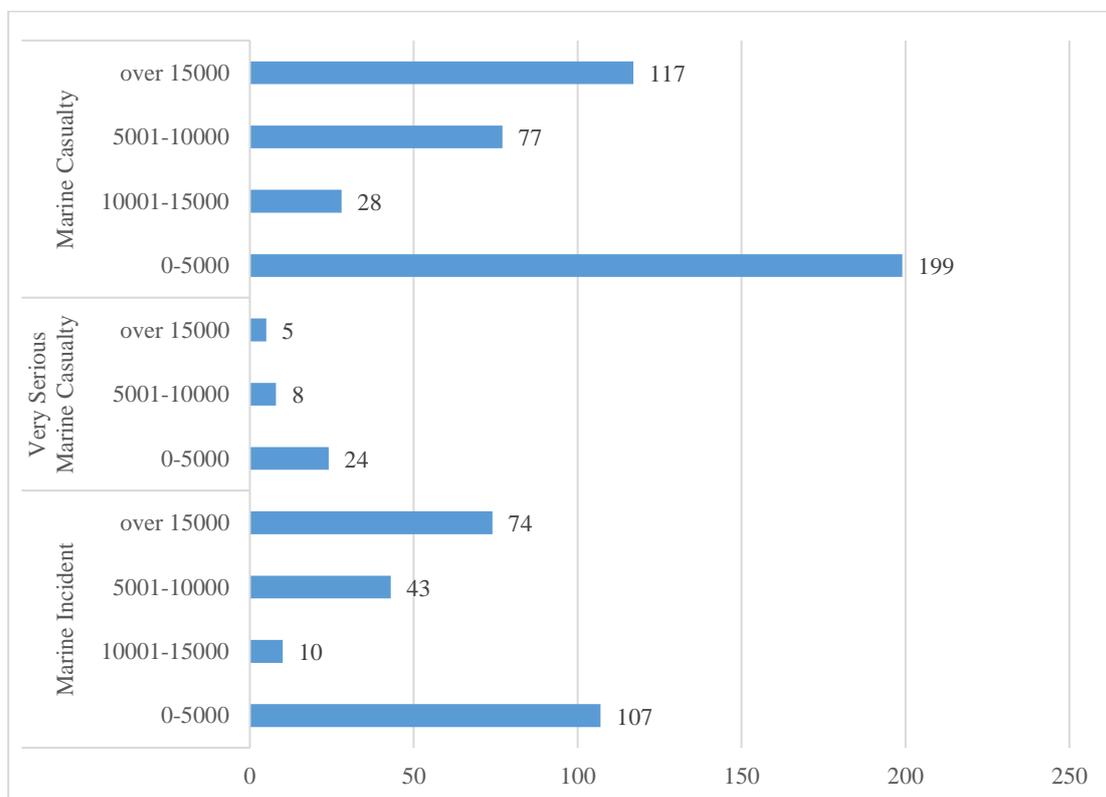
Figure 42 is the pairwise comparison between casualty type and severity. The figure shows that the severity for most of the Contact, Collision, Stranding/grounding, and Machinery damage are classified in category of Marine Casualty. Others are almost being Marine Incident (158). However, Fire/Explosion have no results in any Very Serious Marine Casualty.



Source: Maritime and Port Bureau, MOTC (2021)

Figure 42. Pairwise comparisons between casualty type and severity 2015-2020

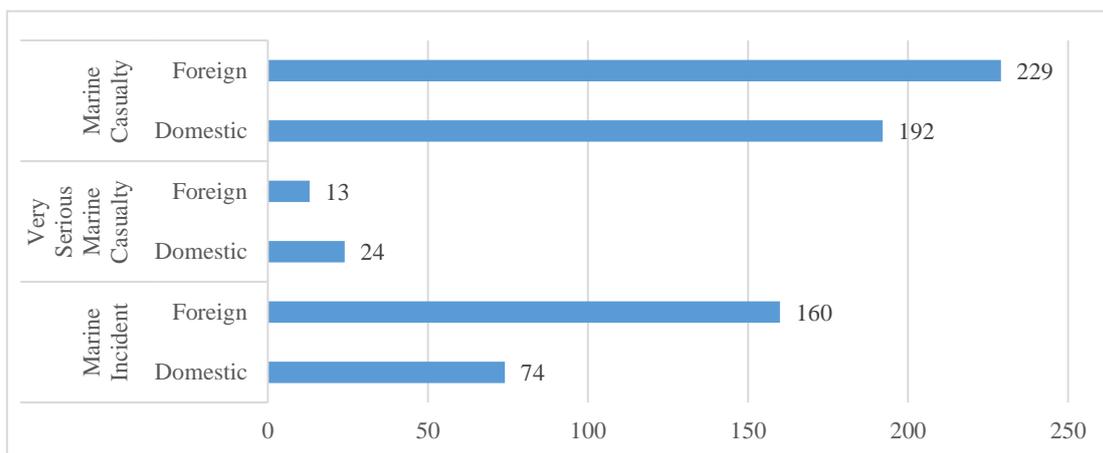
Figure 43 is the pairwise comparison between casualty severity and GT. The number of marine casualties within category of Very Serious Marine Casualty consequences increases when the ship GT decreases. In the Marine Casualty category, ships under 5000 GT have the highest number of occurrences. In addition, ships within the 0-5000 and over 15000 GT, are likely to involve in Marine Incident.



Source: Maritime and Port Bureau, MOTC (2021)

Figure 43. Pairwise comparisons between casualty severity and GT 2015-2020

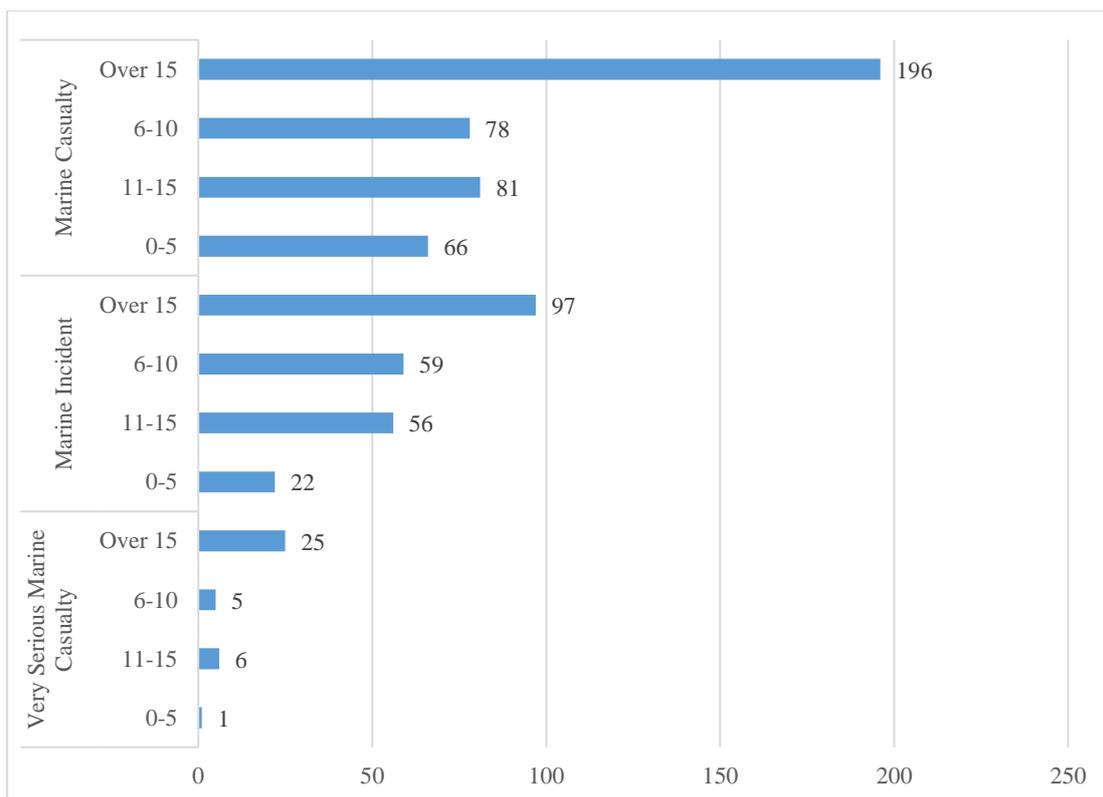
Figure 44 shows the pairwise comparisons between casualty severity and vessel registration. The number of Domestic vessels involved in Very Serious Marine Casualty is higher than that of Foreign ones. Additionally, foreign vessels which were involved in the Marine Casualty category are higher than domestic ones.



Source: Maritime and Port Bureau, MOTC (2021)

Figure 44. Pairwise comparisons between casualty severity and Flag 2015-2020

Figure 45 is the pairwise comparison between casualty severity and ship age. The figure indicates that the number of marine occurrences involving merchant vessels Over 15 years dominates each of the severity category.

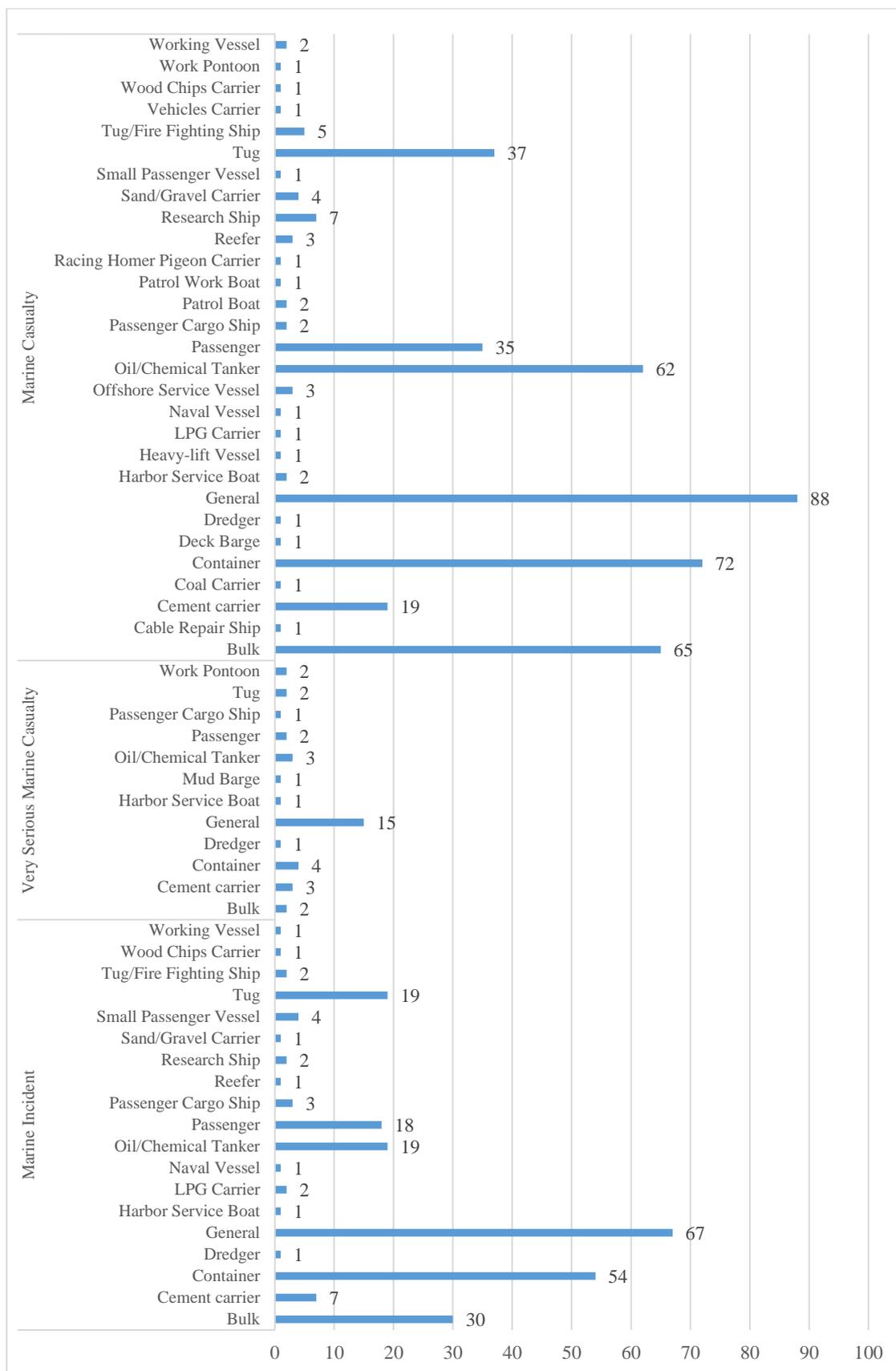


Source: Maritime and Port Bureau, MOTC (2021)

Figure 45. Pairwise comparisons between casualty severity and ship age 2015-2020

Figure 46 shows the pairwise comparison between casualty severity and ship type. According to the figure, General has the highest number of marine casualties in Very Serious Marine Casualty and in Marine Casualty consequences. Followed by Container, Bulk Carrier, Oil/Chemical Tanker. General and Container are the ship types with more

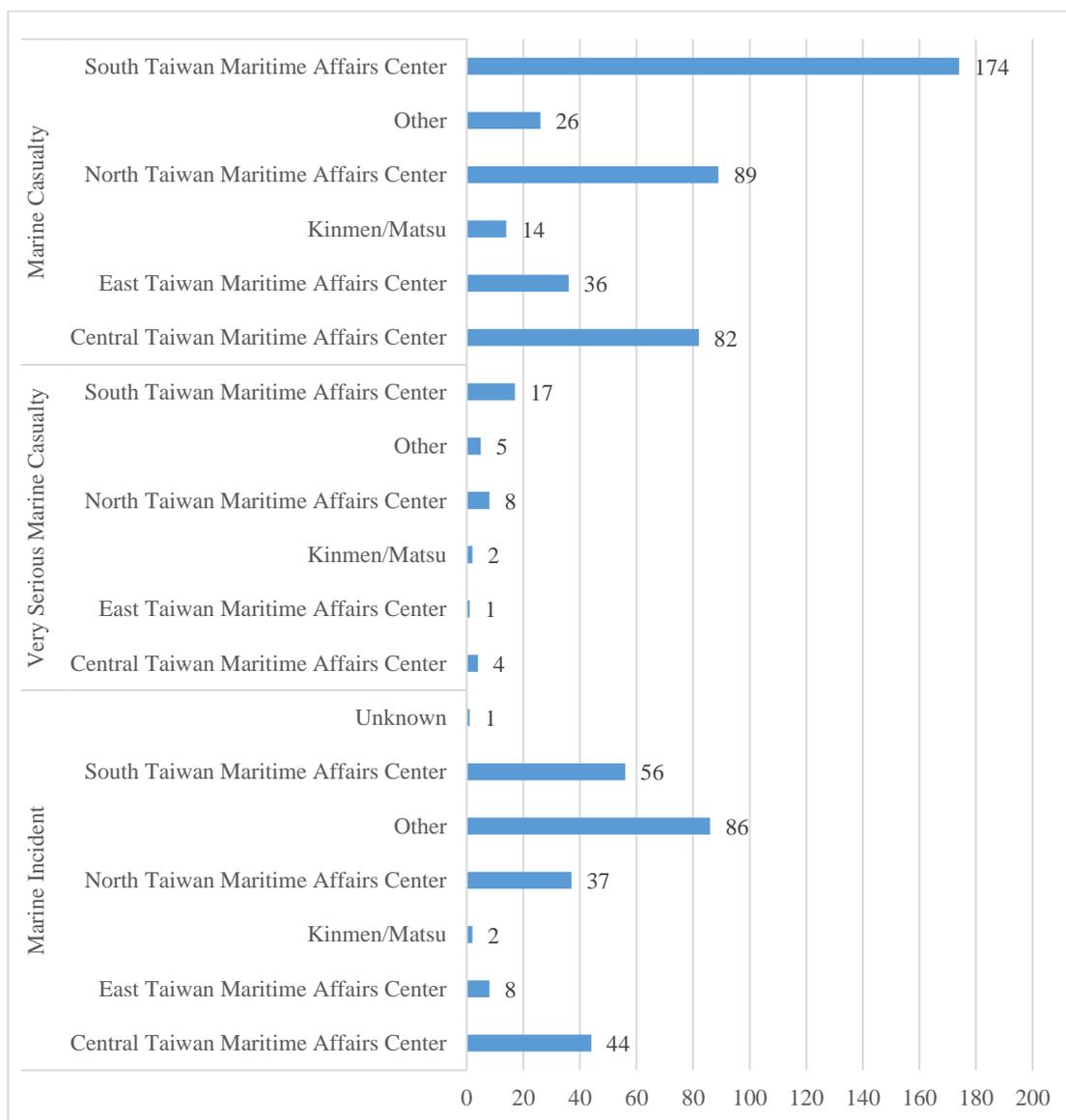
than 50 cases experiencing Marine Incident.



Source: Maritime and Port Bureau, MOTC (2021)

Figure 46. Pairwise comparisons between casualty severity and ship type 2015-2020

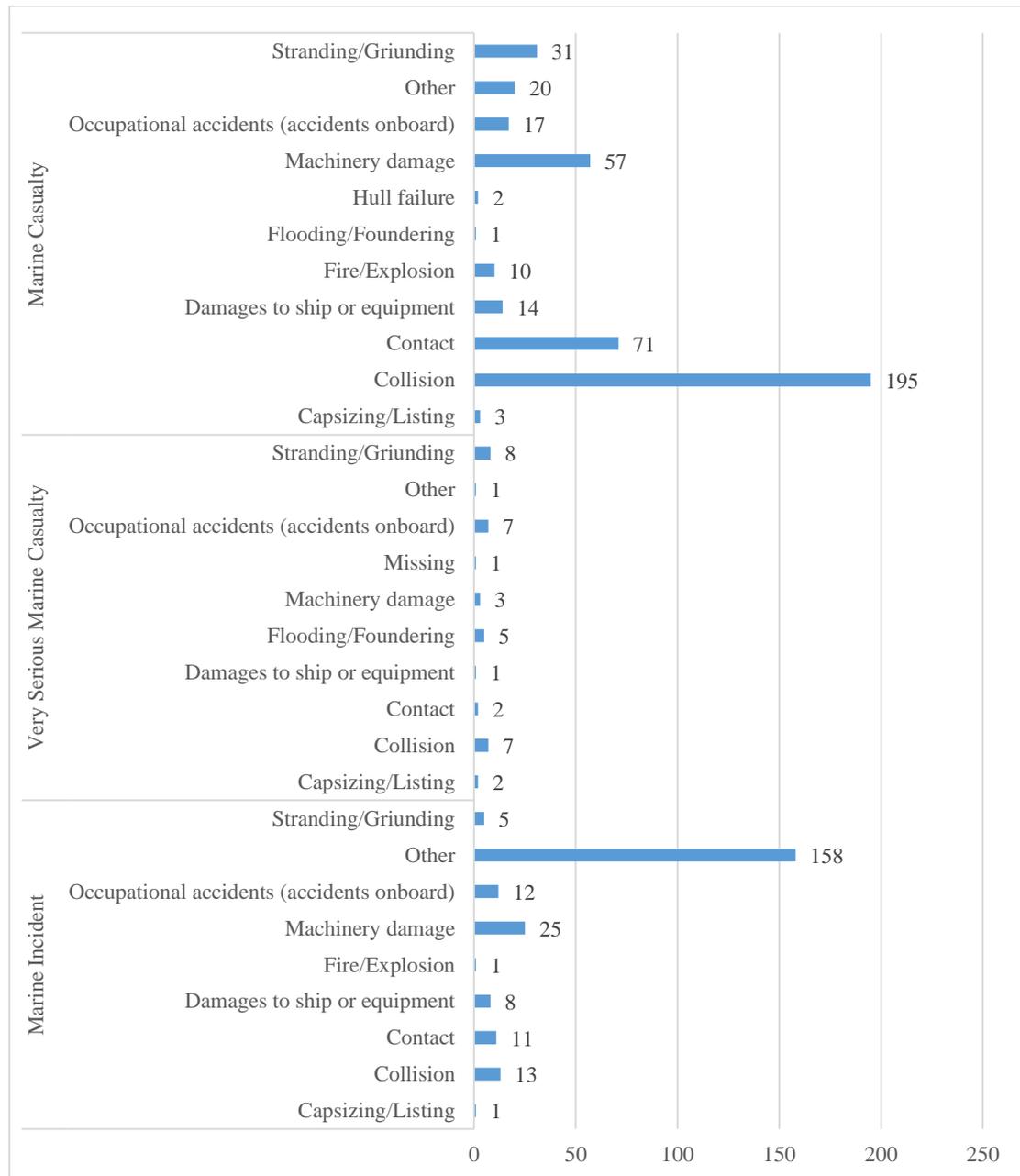
Figure 47 is the pairwise comparison between casualty severity and location. The figure shows that marine casualties with Very Serious Marine Casualty and Marine Casualty consequences are most frequently encountered in the waters under South Taiwan Maritime Affairs Center jurisdiction. The Marine Incident consequences are the most take place in the waters under Other.



Source: Maritime and Port Bureau, MOTC (2021)

Figure 47. Pairwise comparisons between casualty severity and location 2015-2020

Figure 48 is the pairwise comparison between casualty severity and type. Figure 48 indicates that Very Serious Marine Casualty is mainly comprised of Flooding/Foundering, Occupational accidents, and Collision. Marine Casualty consequence is mostly caused by Collision, Stranding/grounding, and Machinery damage.



Source: Maritime and Port Bureau, MOTC (2021)

Figure 48. Pairwise comparisons between casualty severity and accident type 2015-2020

3.2 Marine casualty analysis of fishing vessels

A marine accident overview involving fishing vessels is first conducted in terms of casualty type, ship type, location, GT, annual frequency, and month based on the data from the Fisheries Agency, Council of Agriculture, Executive Yuan. Pairwise comparisons between casualty type, severity, and each element are subsequently initiated.

3.2.1 Overview of marine casualty involving fishing vessels

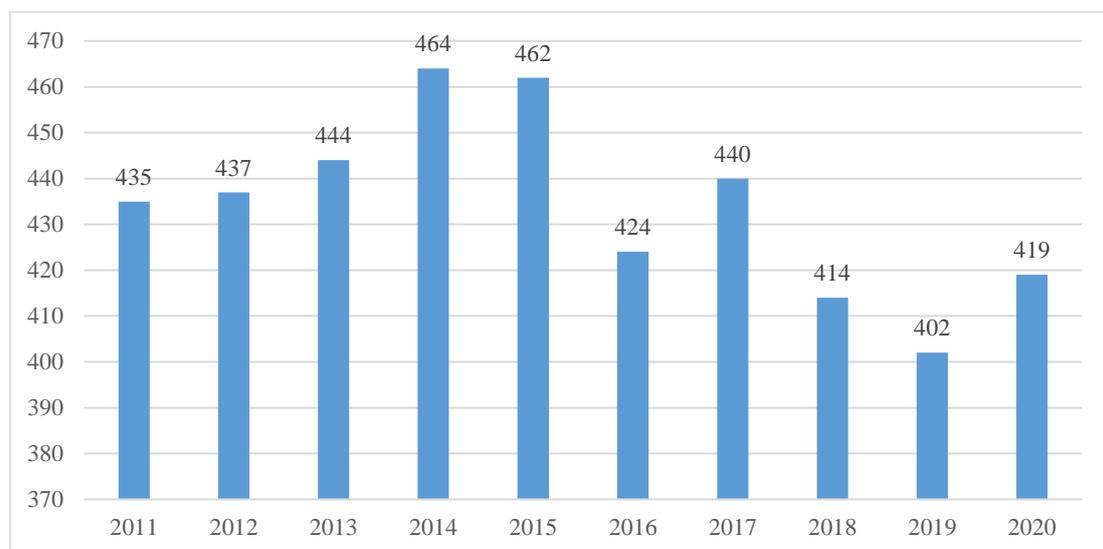
Table 18, Table 19, Table 20, Table 21, Table 22, and Table 23 contain the statistical data of fishing vessel casualties from 2011 to 2020 collected by the Fisheries Agency, Council of Agriculture, Executive Yuan. Data analysis is conducted as follows in terms of casualty type, ship type, location, GT, annual frequency, and month.

Table 18 and Figure 49 show the number of the fishing vessel casualties taking place during the period between 2011 to 2020. The annual casualties' number from 2016-2020 is lower than the number from 2011-2015, showing a descending trend within the decade.

Table 18. Annual frequency of fishing vessel casualties 2011-2020

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	435	437	444	464	462	424	440	414	402	419

Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

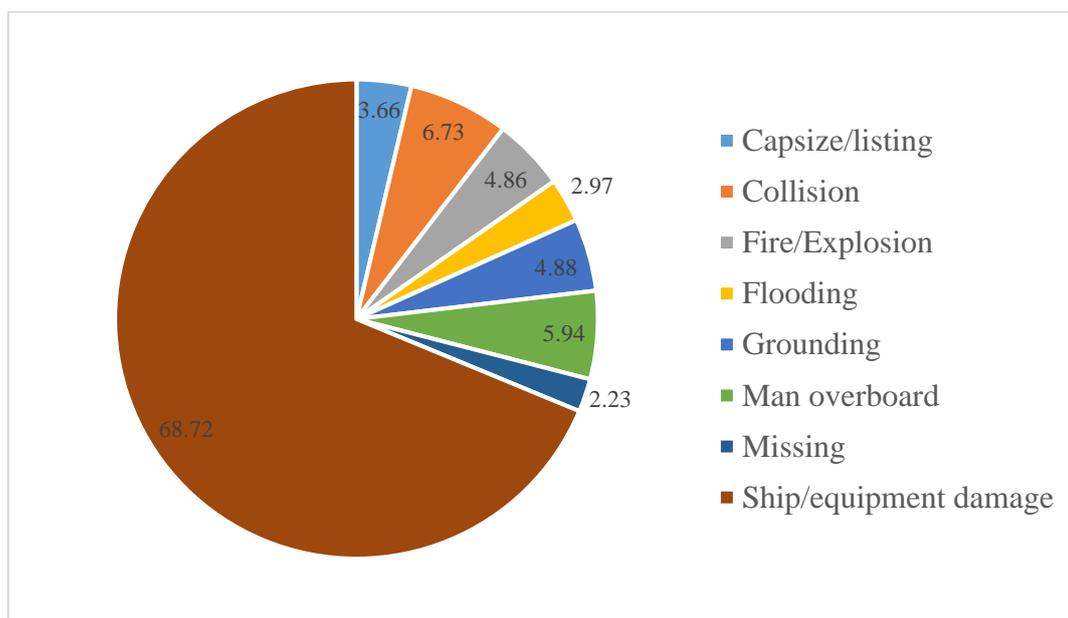
Figure 49. Annual frequency of fishing vessel casualties 2011-2020

Table 19 and Figure 50 express the number and percentage of fishing vessel casualties classified in terms of accident type. Ship/ Equipment damage has the highest number in occurrence, 2983 times in total and accounting for 68.72% during the period between 2011 and 2020.

Table 19. Number and percentage of fishing vessel casualties by accident type 2011-2020

Type of casualty (initial event)	Total	Percentage
Capsize/listing	159	3.66
Collision	292	6.73
Fire/Explosion	211	4.86
Flooding	129	2.97
Grounding	212	4.88
Man overboard	258	5.94
Missing	97	2.23
Ship/equipment damage	2983	68.72
Total	4341	100

Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

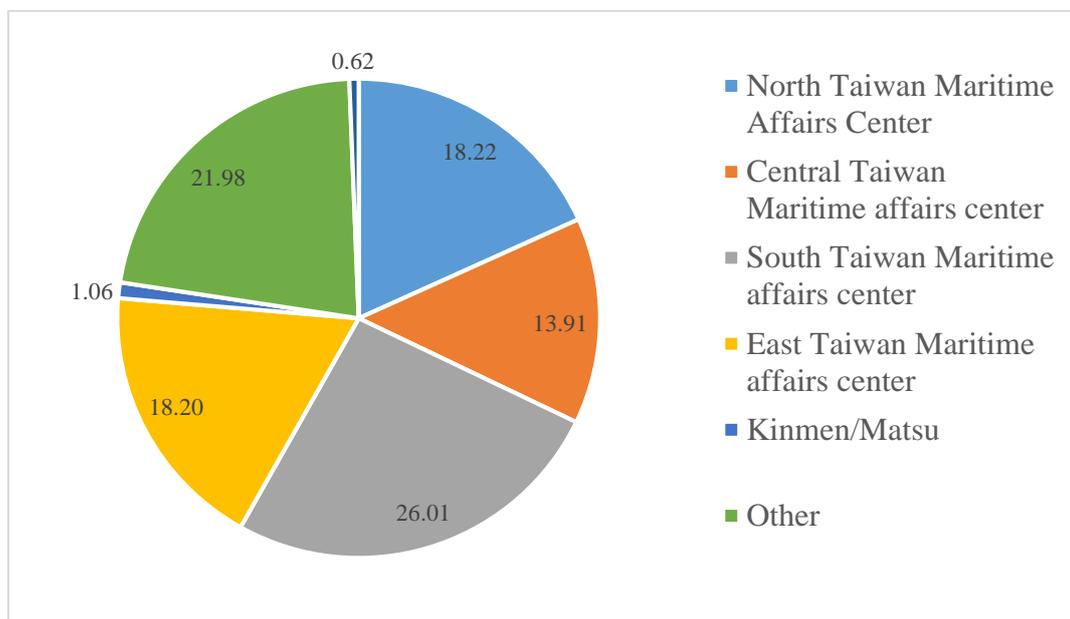
Figure 50. Percentage of fishing vessel casualties by accident type 2011-2020

Table 20 and Figure 51 list the number and percentage of fishing vessel casualties in terms of locations. Casualties are the most likely to occur in the waters under the jurisdiction of South Taiwan Maritime Affairs Center, followed by Other, North, East, and Central Taiwan Maritime Affairs Centers as well as Kinmen/Matsu.

Table 20. Number and percentage of fishing vessel casualties by locations 2011-2020

Location	Total	Percentage
North Taiwan Maritime Affairs Center	791	18.22
Central Taiwan Maritime affairs center	604	13.91
South Taiwan Maritime affairs center	1129	26.01
East Taiwan Maritime affairs center	790	18.20
Kinmen/Matsu	46	1.06
Other	954	21.98
Unknown	27	0.62

Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

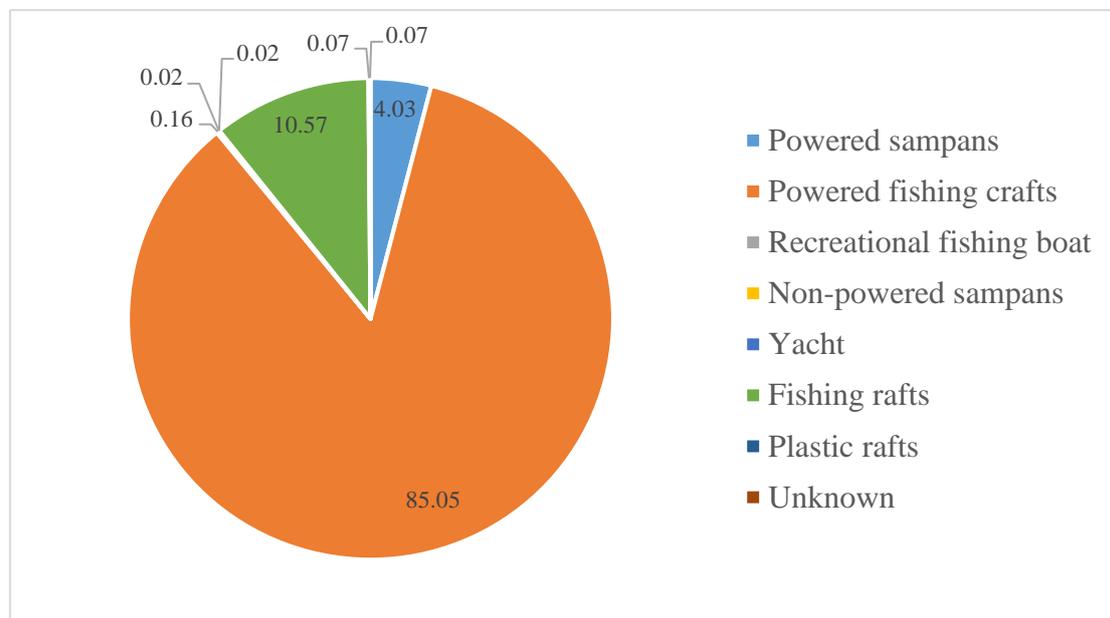
Figure 51. Percentage of fishing vessel casualties by locations 2011-2020

Table 21 and Figure 52 contain the number and percentage of fishing vessel casualties in terms of ship type. Over 80% of the accidents were taken place onboard Powered fishing crafts, followed by Fishing rafts and Powered sampans.

Table 21. Number and percentage of fishing vessel casualties by ship type 2011-2020

Ship type	Total	Percentage
Powered fishing crafts	3692	85.05
Powered sampans	175	4.03
Recreational fishing boat	7	0.16
Yacht	1	0.02
Fishing rafts	459	10.57
Plastic rafts	3	0.07
Non-powered sampans	1	0.02
Unknown	3	0.07

Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

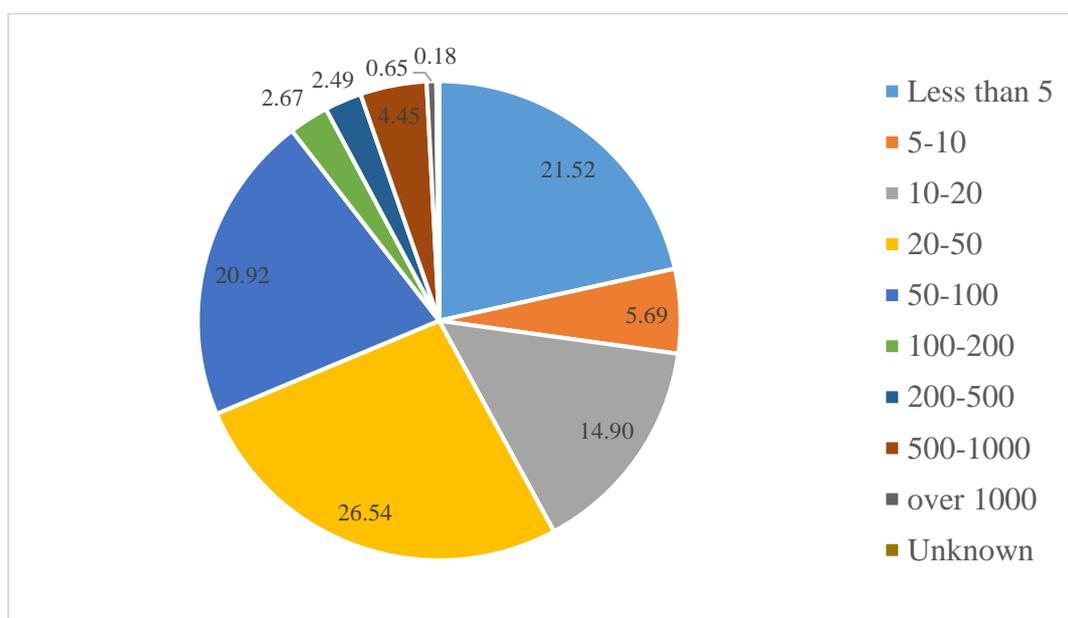
Figure 52. Percentage of fishing vessel casualties by ship type 2011-2020

Table 22 and Figure 53 express the number and percentage of fishing vessel casualties in terms of GT. Most accidents are encountered by fishing vessels under 100 GT among which 20-50, under 5, and 50-100 GT categories account for 26.54%, 21.52%, and 20.92%, respectively.

Table 22. Number and percentage of fishing vessel casualties by GT 2011-2020

GT	Total	Percentage
Less than 5	934	21.52
5-10	247	5.69
10-20	647	14.90
20-50	1152	26.54
50-100	908	20.92
100-200	116	2.67
200-500	108	2.49
500-1000	193	4.45
over 1000	28	0.65
Unknown	8	0.18

Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

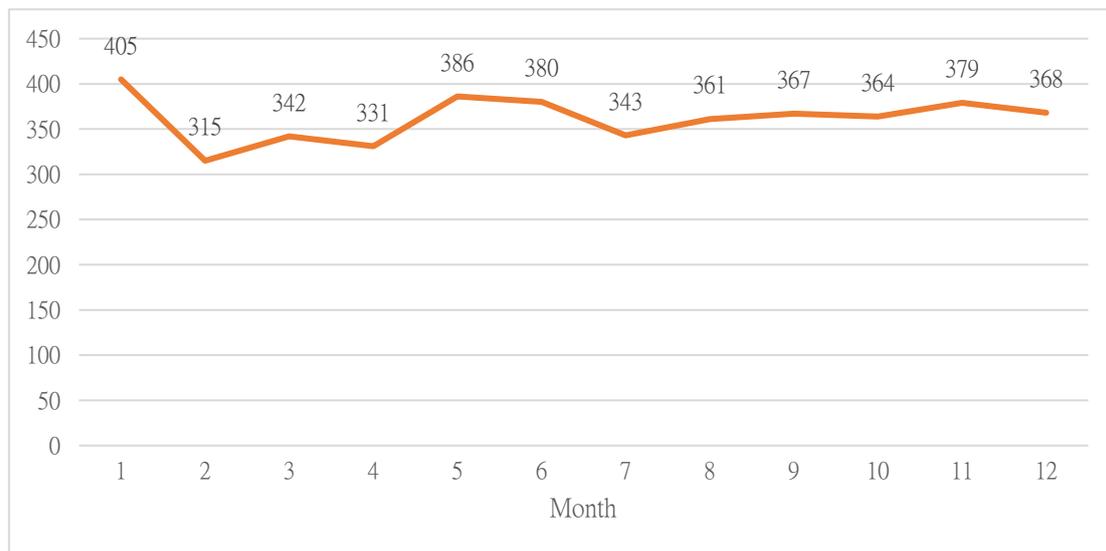
Figure 53. Percentage of fishing vessel casualties by GT 2011-2020

Table 23 and Figure 54 list the number and percentage of monthly fishing vessel occurrences during the period between 2011 and 2020. The highest accident occurrence months in descending order are January, May and June whereas February and April encounter least shipping casualties.

Table 23. Number and percentage of monthly fishing vessel casualty occurrence 2011-2020

Month	2011-2020	Percentage
January	405	9.33
February	315	7.26
March	342	7.88
April	331	7.62
May	386	8.89
June	380	8.75
July	343	7.90
August	361	8.32
September	367	8.45
October	364	8.39
November	379	8.73
December	368	8.48
Total	4341	100

Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

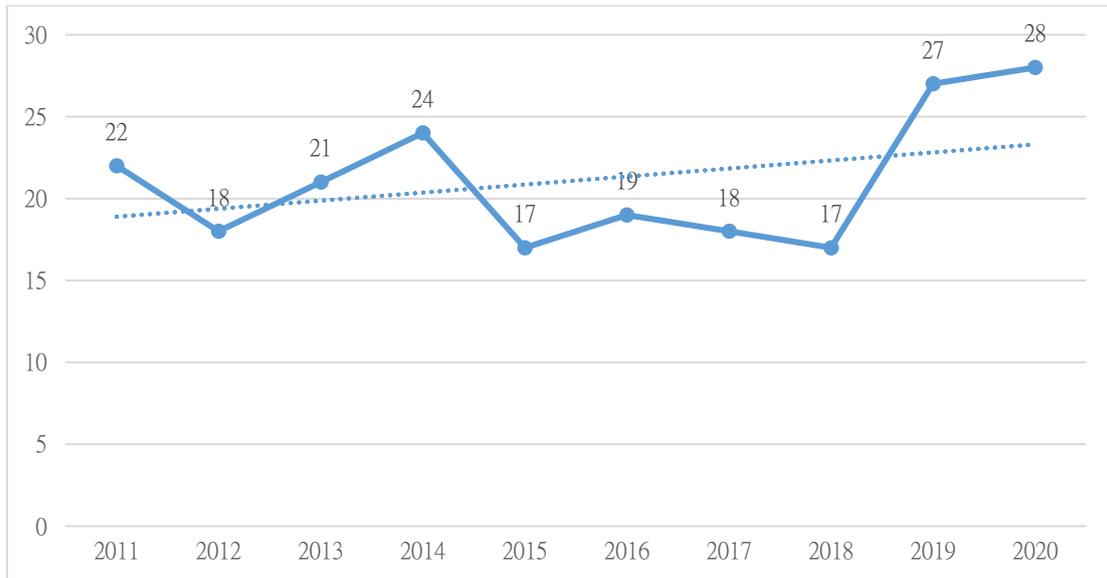


Source: Fisheries Agency, Council of Agriculture, Executive Yuan, (2021)

Figure 54. Number of monthly fishing vessel casualty occurrence 2011-2020

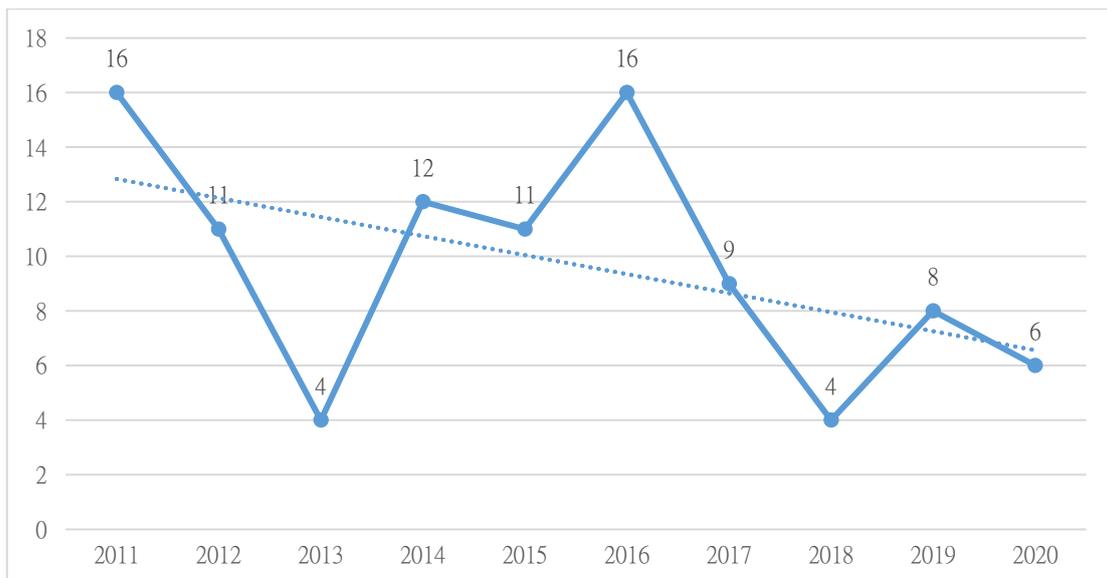
The information in Figure 55 to Figure 62 shows the annual trend analysis of Fire/explosion, Missing, Ship/equipment damage, Flooding, Collision, Man overboard, Grounding, and Capsize/listing involving fishing vessels from 2011 to 2020. As illustrated from the figures that, Missing, Flooding, Man overboard, and Capsize/listing express a declining trend within the period. On the other hand, Fire/explosion,

Grounding, Ship/equipment damage, and Collision show a slightly increasing tendency.



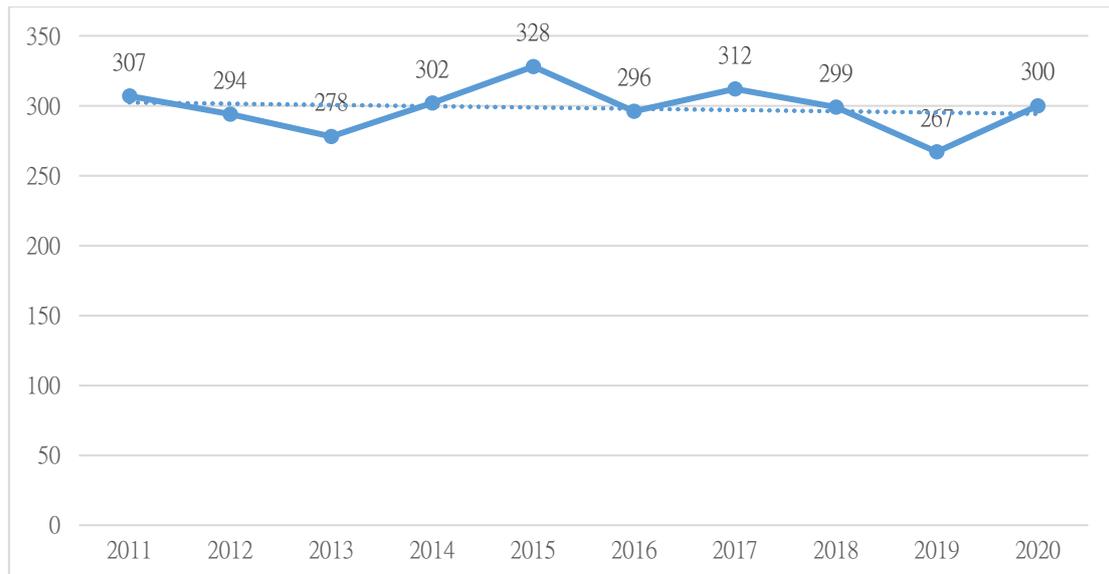
Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 55. Annual trend analysis of fishing vessel fire/explosion 2011-2020



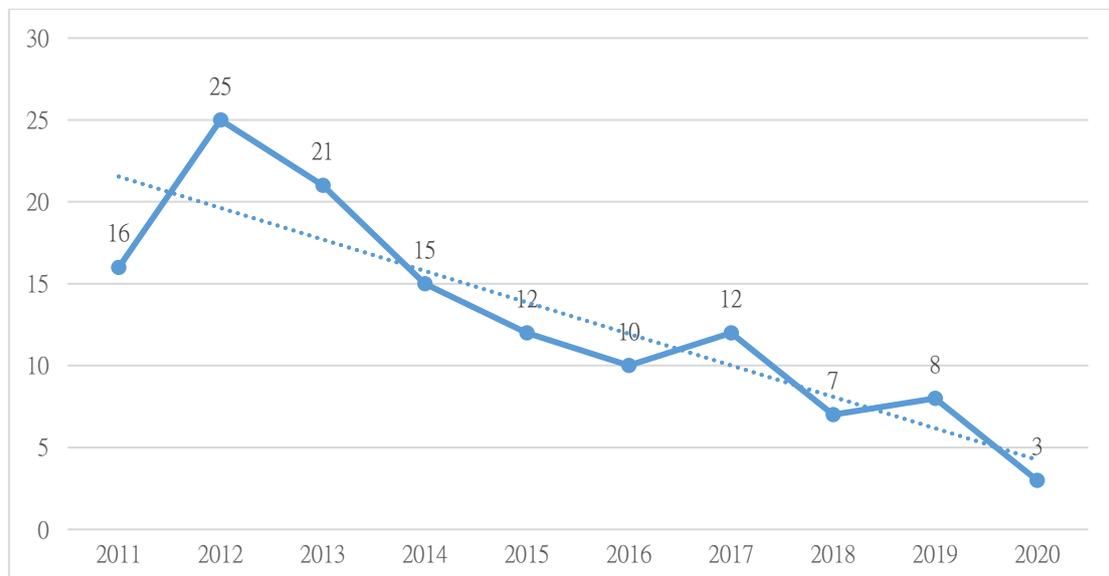
Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 56. Annual trend analysis of fishing vessel missing 2011-2020



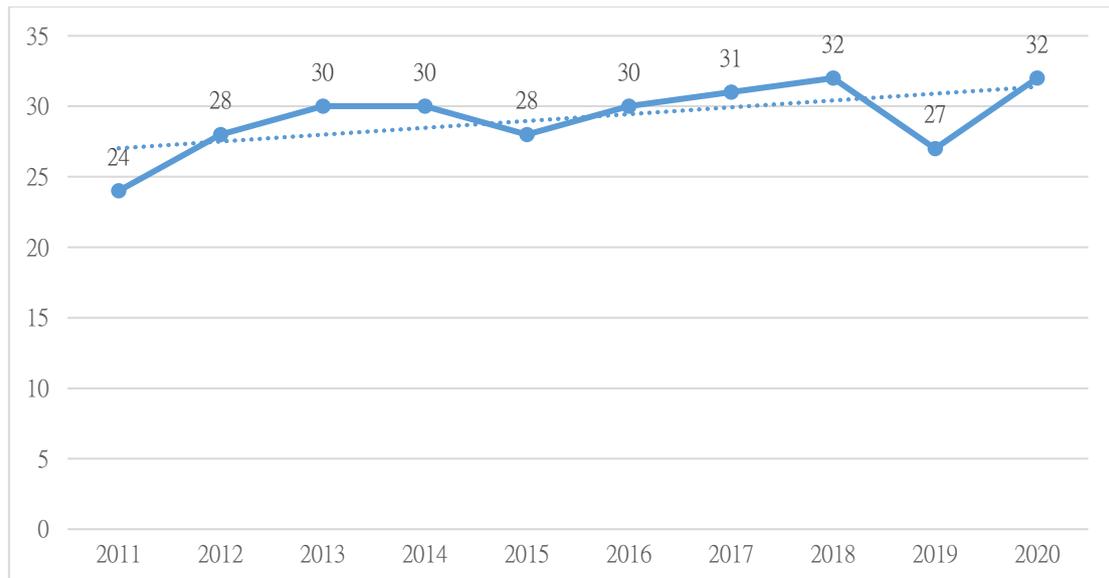
Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 57. Annual trend analysis of fishing vessel ship/equipment damage 2011-2020



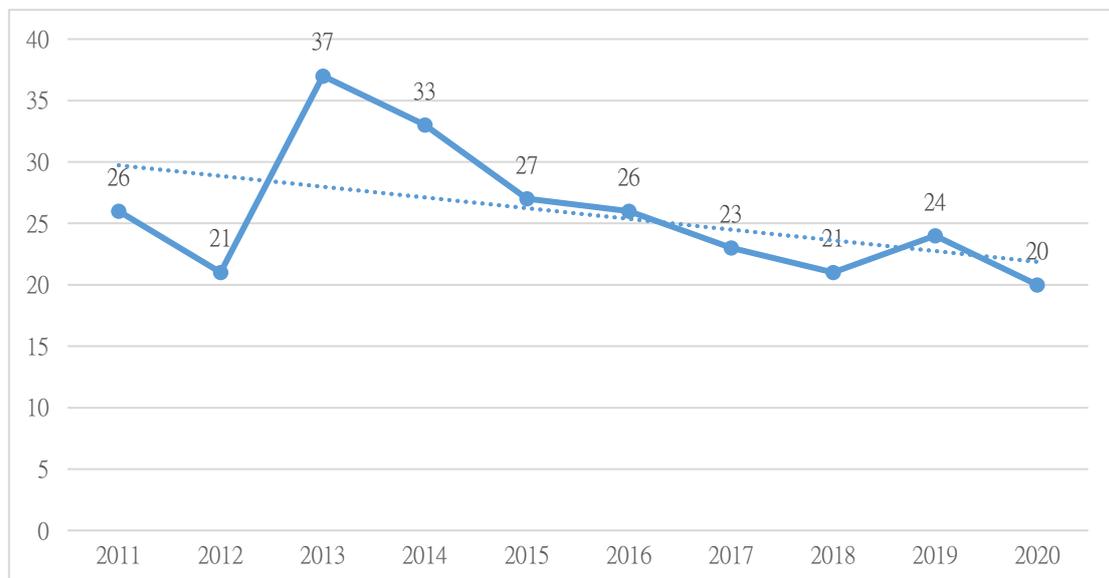
Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 58. Annual trend analysis of fishing vessel flooding 2011-2020



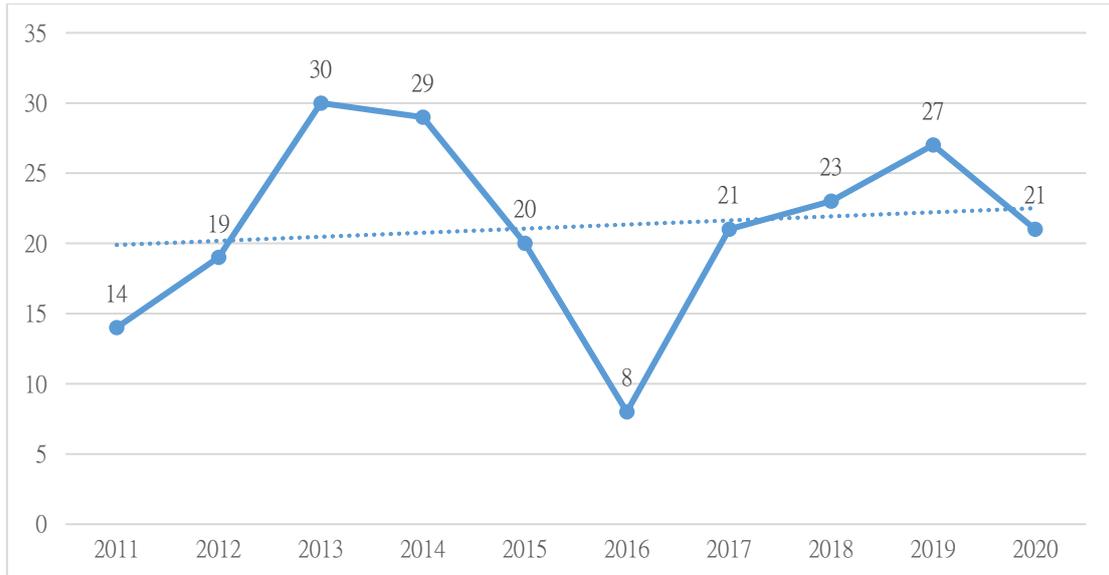
Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 59. Annual trend analysis of fishing vessel collision 2011-2020



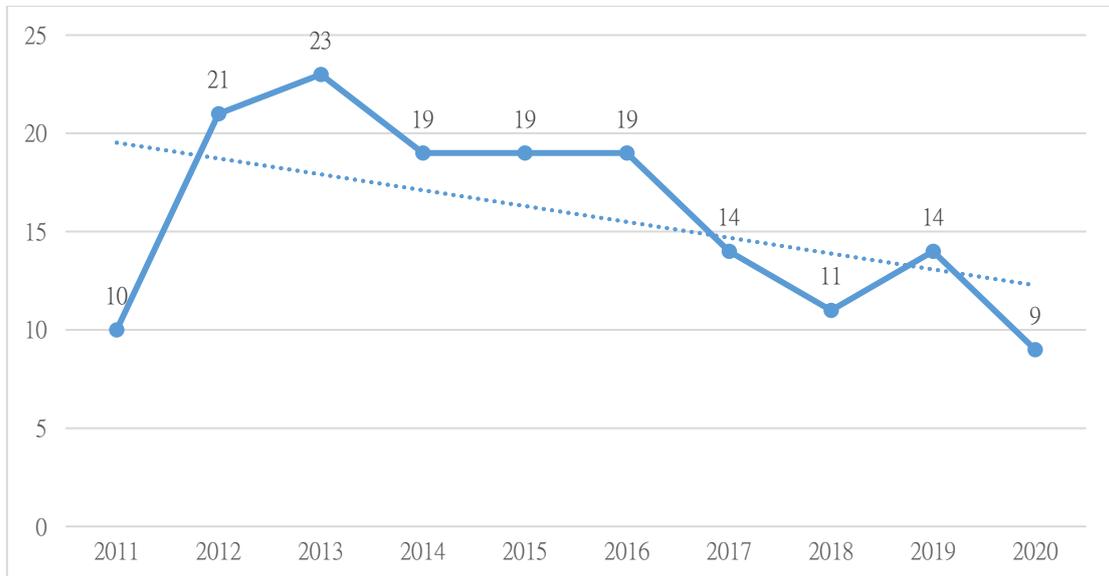
Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 60. Annual trend analysis of fishing vessel man overboard 2011-2020



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

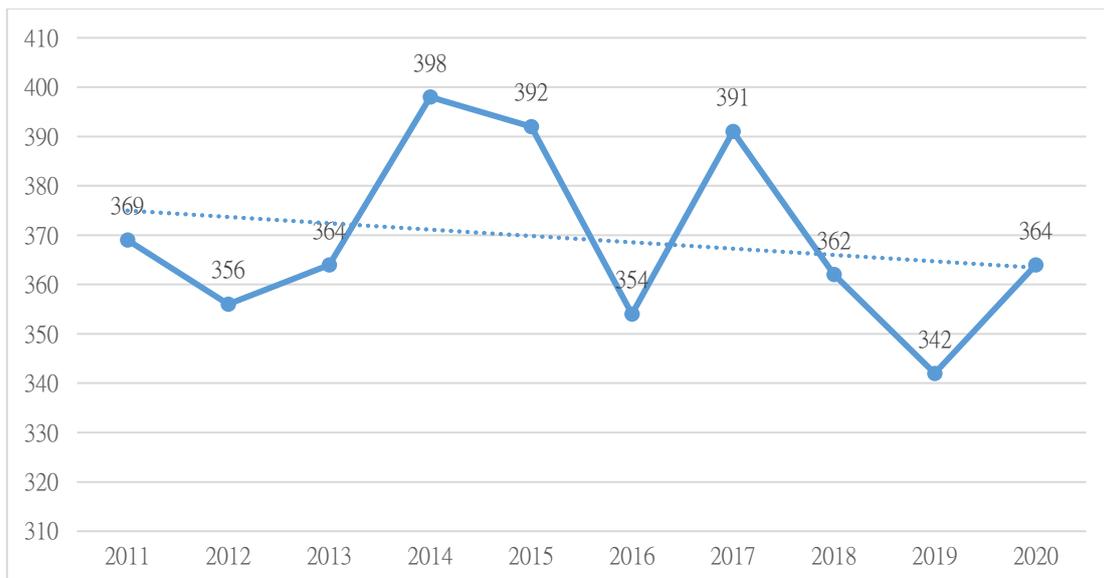
Figure 61. Annual trend analysis of fishing vessel grounding 2011-2020



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

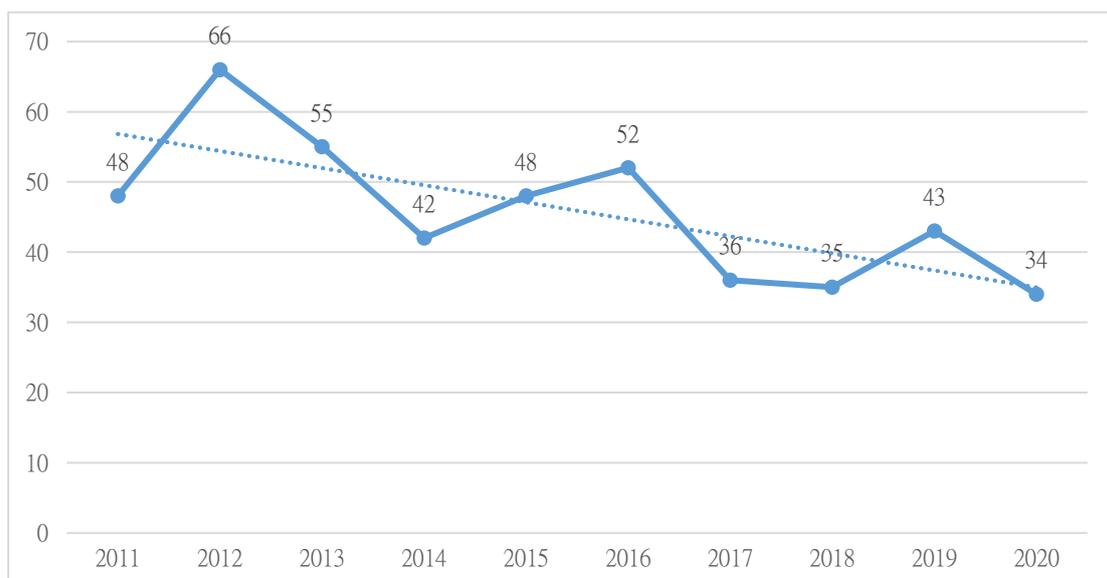
Figure 62. Annual trend analysis of fishing vessel capsizing/listing 2011-2020

Figure 63, Figure 64 ,and Figure 65 contain the annual trend analysis of marine casualties involving Powered fishing craft, Fishing raft ,and Powered sampan taking place from 2011 to 2020. Figure 63 indicates that the shipping accidents involving Powered fishing craft show a significantly decline trend whereas those involving the other two ship types express a declining tendency during the period as well (shown as Figures 64 and 65).



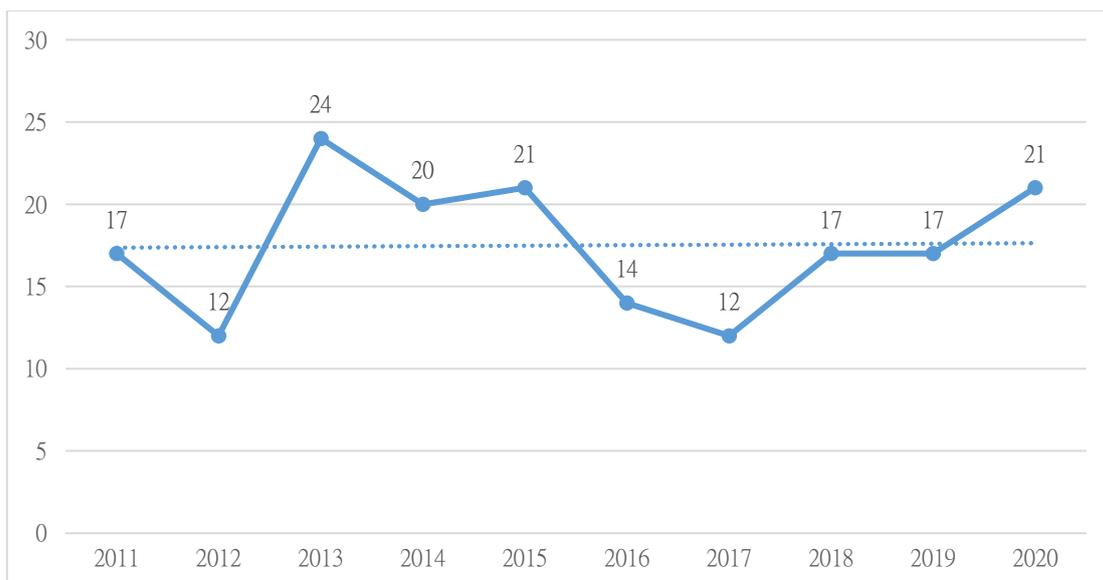
Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 63. Annual trend analysis of marine occurrences involving powered fishing crafts 2011-2020



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 64. Annual trend analysis of marine occurrences involving fishing rafts 2011-2020

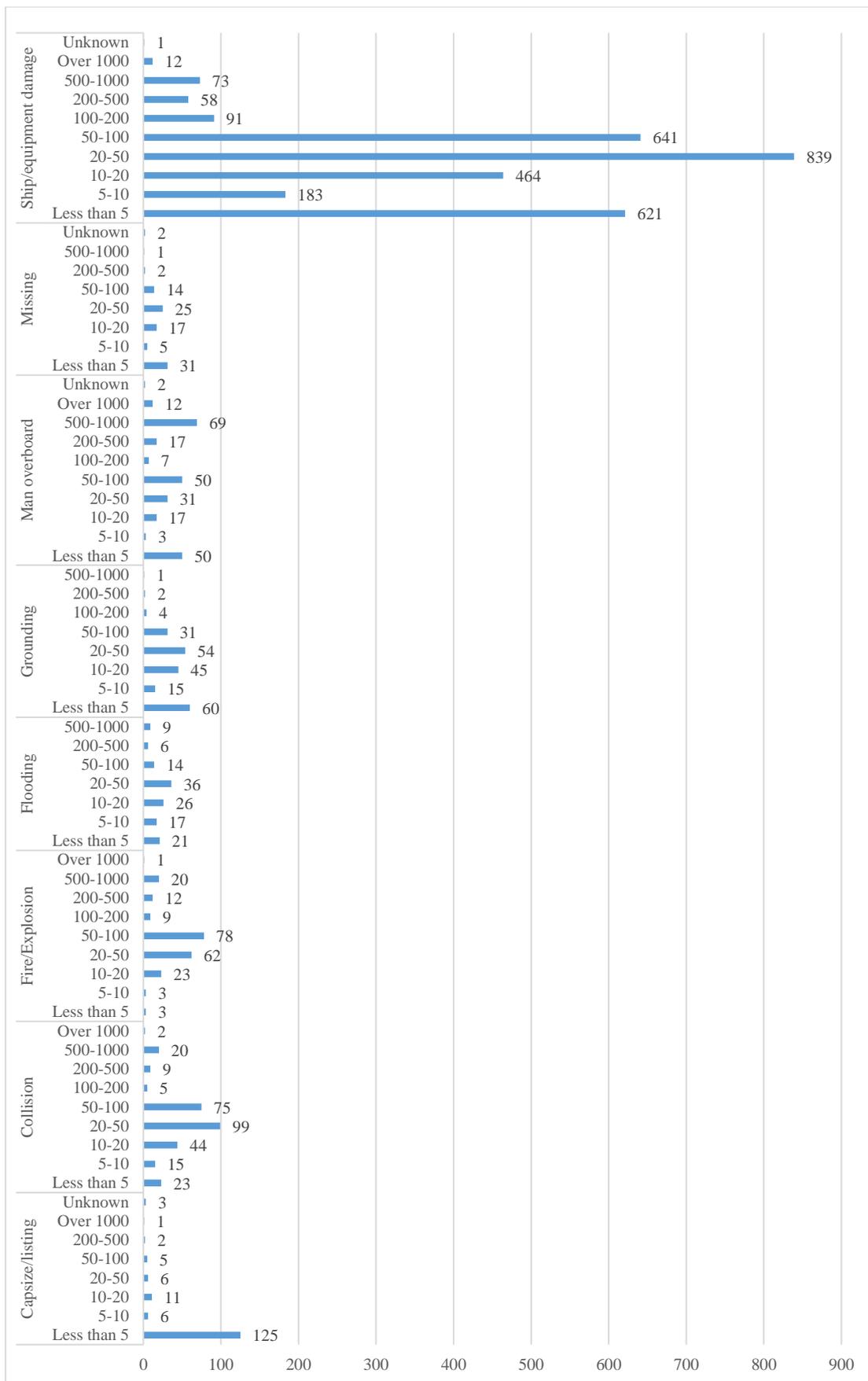


Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 65. Annual trend analysis of marine occurrences involving powered sampans 2011-2020

3.2.2 Pairwise comparisons between elements for fishing vessel casualties

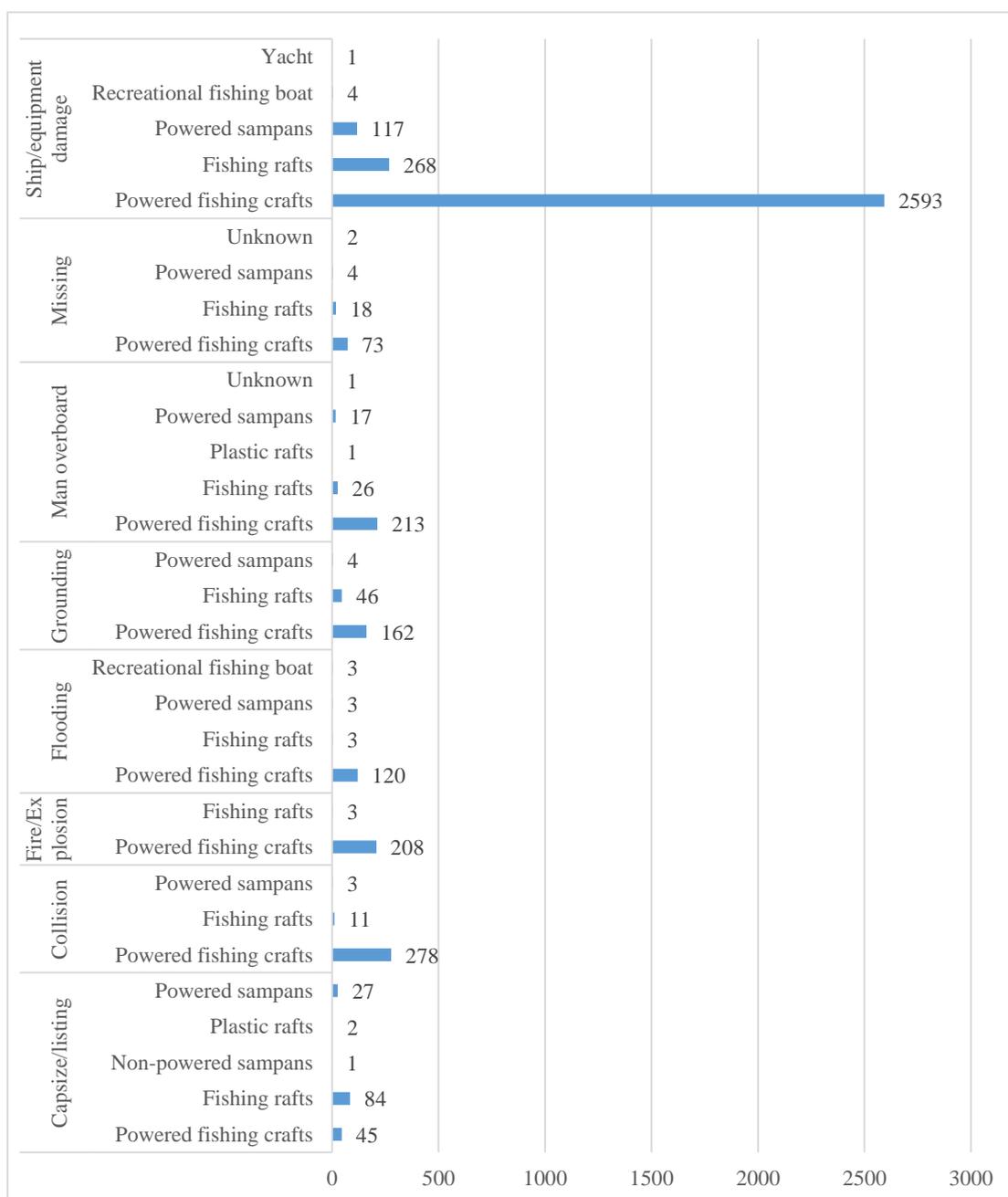
Figure 66 shows the pairwise comparisons between casualty type and GT. According to the figure, ships under 100 GT tend to suffer from Ship/equipment damage. Ships under 5 GT tend to suffer from Capsize/Listing and Grounding. The GT categories that are likely to encounter Man overboard include the 500-1000 GT, 50-100 GT, under 5 GT, and 20-50 GT groups of which the frequency is over 30. Ships under 20-50 GT category are likely to confront with Collision and Flooding. Ships under 5 GT and within 10-100 GT are the main fishing vessels contributing to Missing. Fishing crafts within 20-100 GT are liable to suffer from Fire/explosion.



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 66. Pairwise comparisons between casualty type and GT 2011-2020

Figure 67 expresses the pairwise comparisons between casualty type and ship type. Powered fishing craft is the ship type that most frequently encounters Ship/equipment damage with a value of 2593, it is significantly higher than the other vessel groups. In addition, apart from Capsize/listing, the accident frequencies of such a ship type also dominate the other casualty categories, including Missing, Man overboard, Grounding, Flooding, Fire/explosion, and Collision.

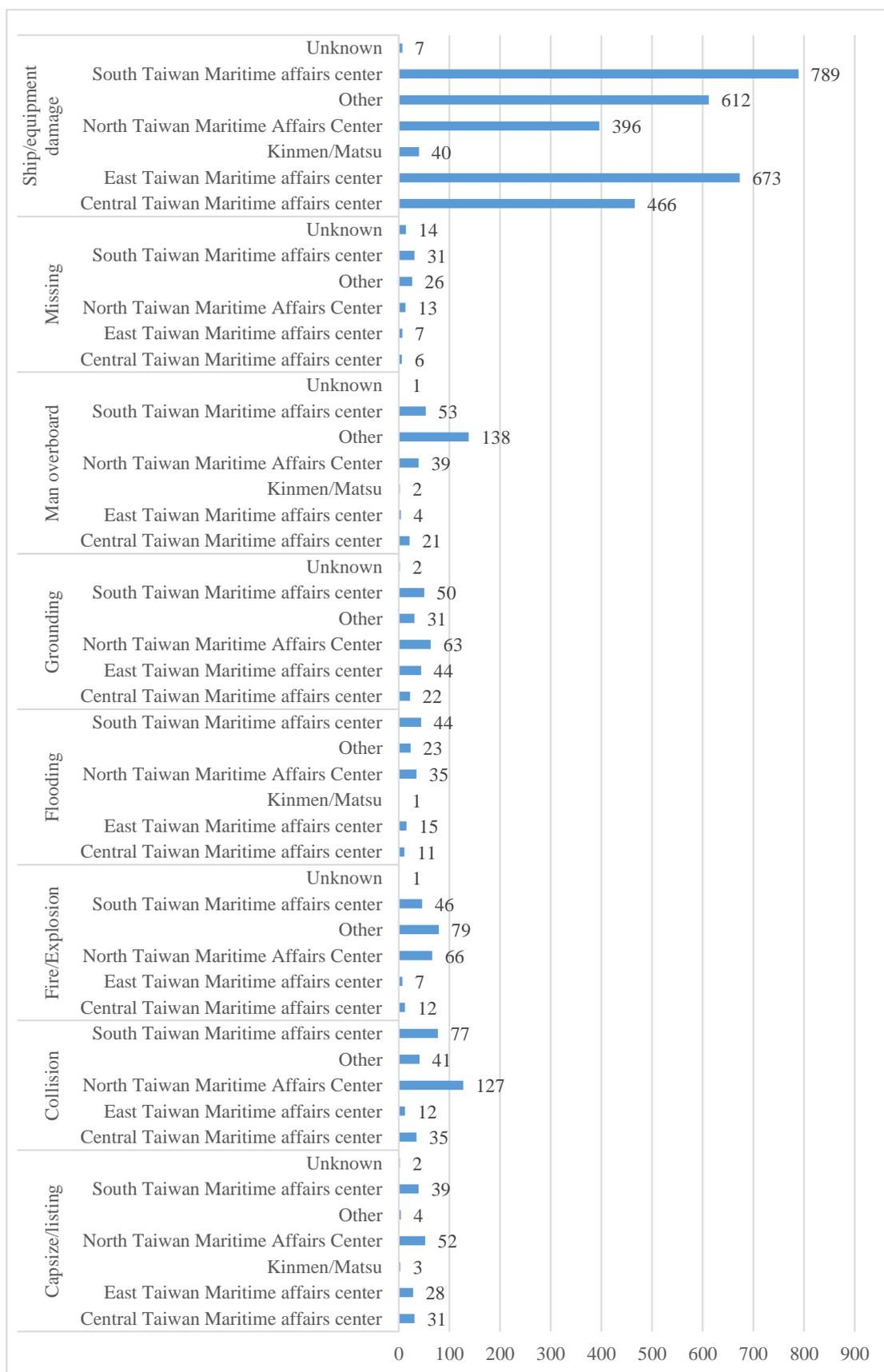


Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 67. Pairwise comparisons between casualty and ship types 2011-2020

Figure 68 shows the pairwise comparisons between casualty type and location. According to the figure, Ship/equipment damage most often takes place in the waters

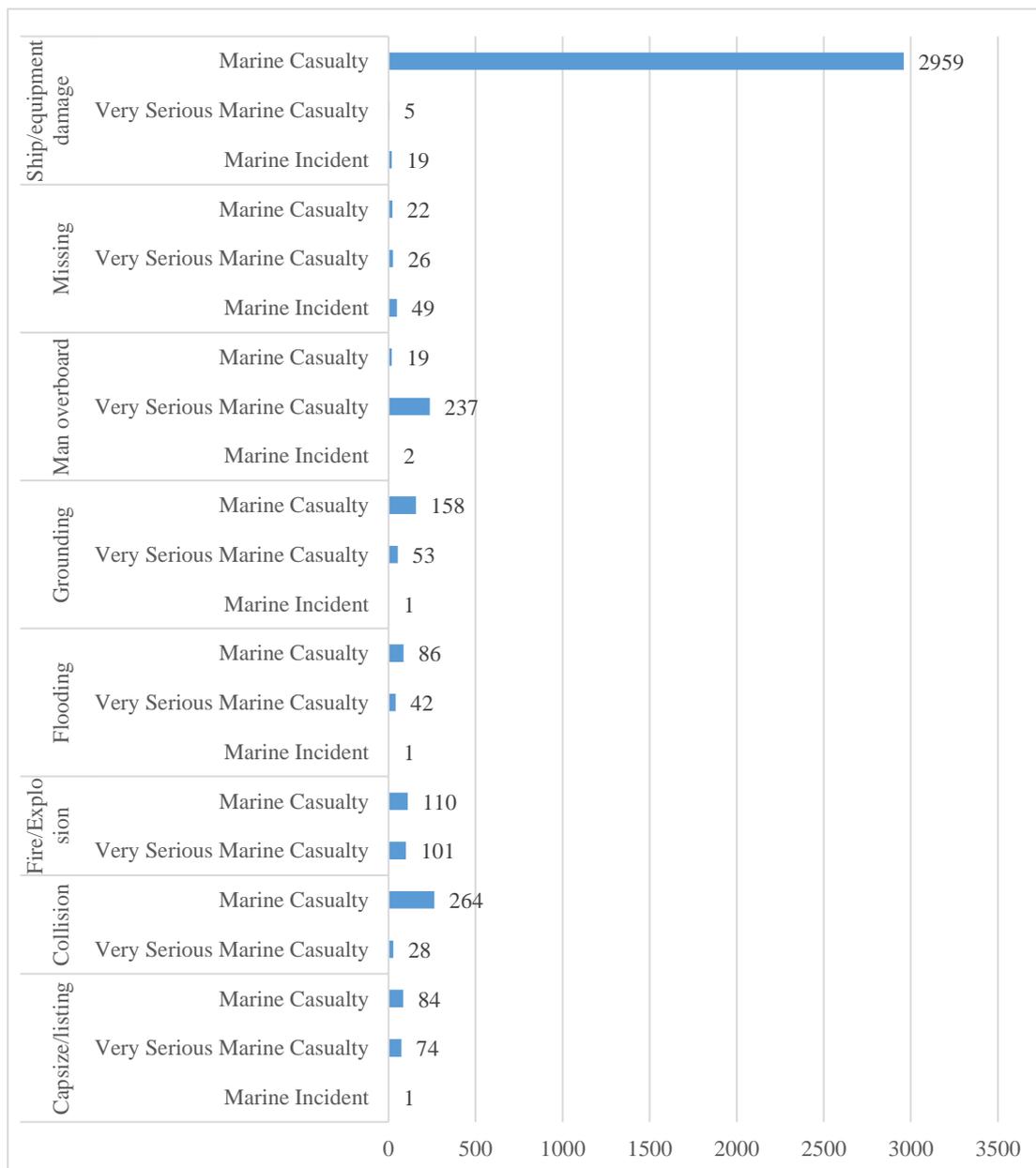
under the jurisdictions of South and East Taiwan Maritime Affairs Centers. The most frequently occurring area for Missing is South Taiwan Maritime Affairs Center, followed by Other waters. Apart from the Other category, Man overboard, Flooding, Fire/explosion, Collision and Capsize/listing most often take place in waters of South and North Taiwan Maritime Affairs Centers. The most Grounding occurrence locations in descending order are North, South, and East Taiwan Maritime Affairs Centers.



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 68. Pairwise comparisons between casualty type and location 2011-2020

Figure 69 contains the pairwise comparisons between casualty type and severity. The figure indicates that Very Serious Marine Casualty consequence is liable to incur once encountering Man overboard and Capsize/listing. Fishing vessels involved in Grounding and Collision tend to have Marine Casualty consequences. In addition, Ship/equipment damage is the most frequent accident type among all casualty categories and the majority of such unwanted events tend to be associated with Marine Casualty consequences.

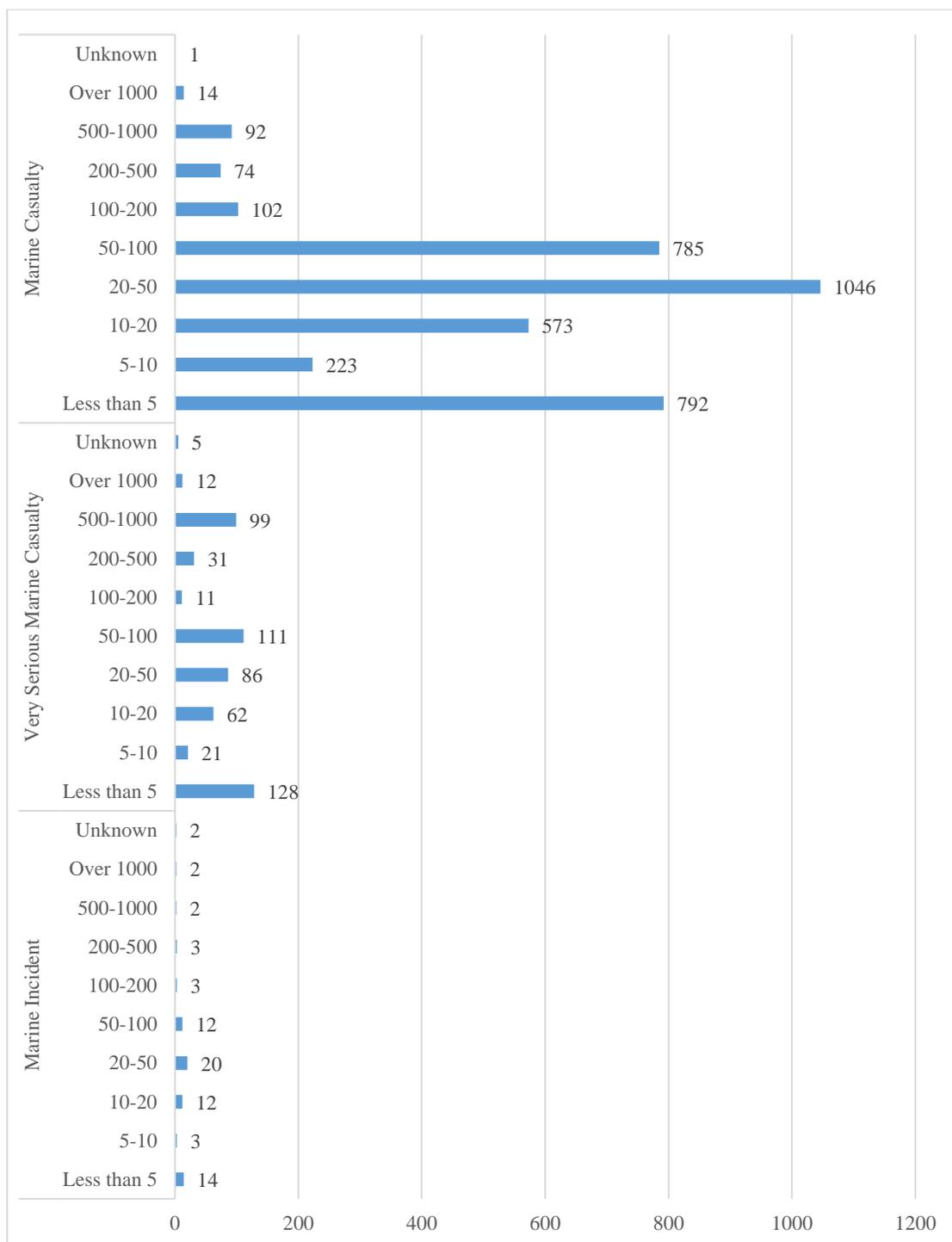


Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 69. Pairwise comparisons between casualty type and severity 2011-2020

Figure 70 expresses the pairwise comparisons between casualty type and GT. It shows that fishing crafts in Less than 5, 50-100 and 500-1000 GT categories are liable

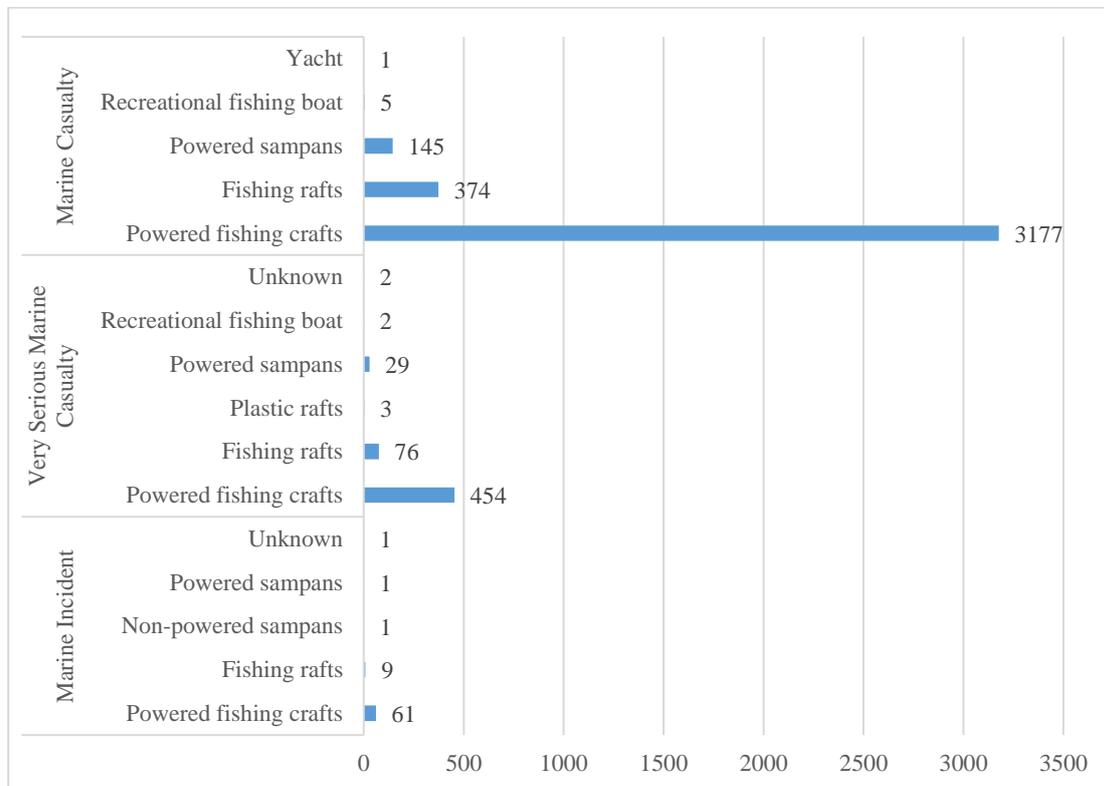
to encounter marine casualties with Very Serious Marine Casualty consequences, of which the frequencies are more than 100. The top 4 GT categories that most frequently confront accidents with Marine Casualty consequences are 20-50, Less than 5, 50-100, and 10-20 groups, of which the number of occurrences are all over 500. Fishing vessels in the 20-50 category is likely to encounter casualties with Marine Incident consequences.



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 70. Pairwise comparisons between casualty severity and GT 2011-2020

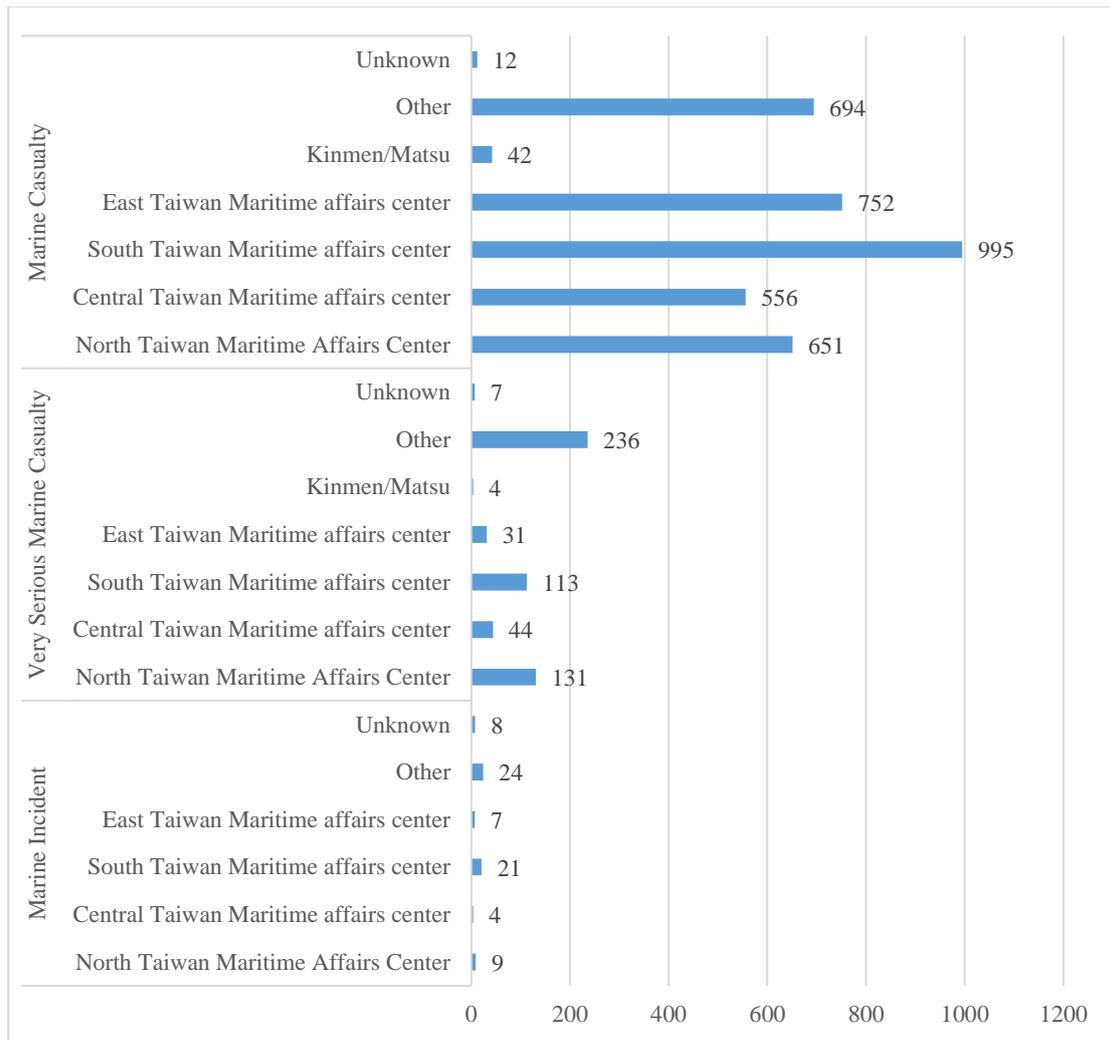
Figure 71 lists the pairwise comparisons between casualty severity and vessel type. The figure shows that the frequency of Powered fishing crafts dominates each of the severity categories. Fishing raft, on the other hand, is the second most frequently occurring vessel type in all severity categories.



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 71. Pairwise comparisons between severity and ship type 2011-2020

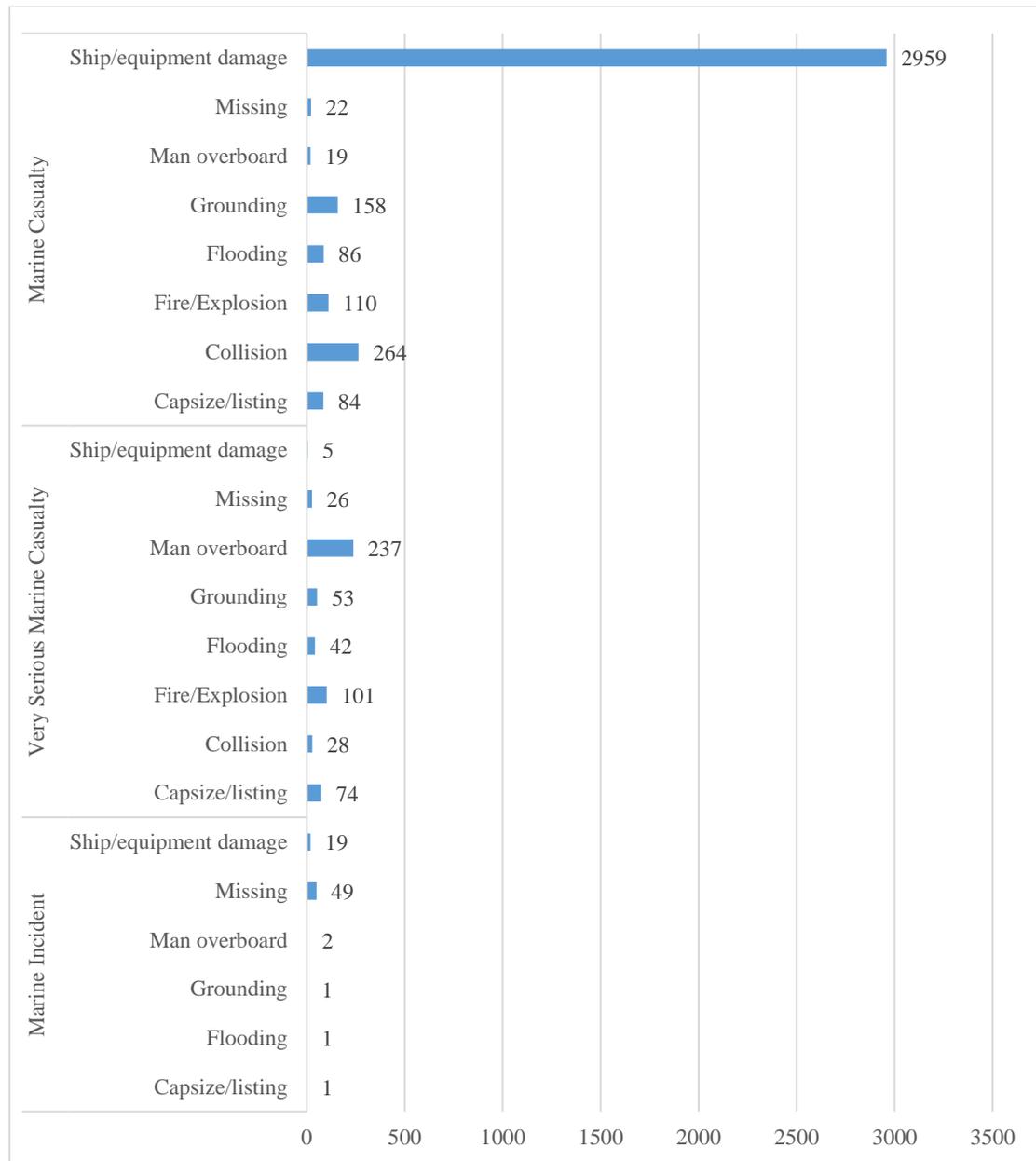
Figure 72 contains the pairwise comparisons between casualty severity and locations. Apart from Other waters, the areas under the jurisdictions of North and South Taiwan Maritime Affairs Centers are liable for casualties of Very Serious Marine Casualty to take place. The waters under the supervision by South Taiwan Maritime Affairs Center tend to frequently encounter the Marine Casualty occurrence, followed by East, Other, and North Taiwan Maritime Affairs Centers.



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 72. Pairwise comparisons between severity and location 2011-2020

Figure 73 shows the pairwise comparisons between casualty severity and type. Man overboard and Fire/explosion are the accident categories that most frequently lead to Very Serious Marine Casualty consequences. The number of Ship/equipment damage occurrences dominates the category of Marine Casualty consequence.



Source: Fisheries Agency, Council of Agriculture, Executive Yuan (2021)

Figure 73. Pairwise comparisons between severity and casualty type 2011-2020

4. Major marine occurrence investigation statistics of Taiwan Transportation Safety Board

According to the Transportation Occurrences Investigation Act Article 6, there are three conditions that TTSB should conduct the occurrence investigation: (a) Any transportation occurrence arises in the territory of the Republic of China (hereinafter referred to as ROC); (b) When a major transportation occurrence of ship registered in the ROC or operated by a shipping company incorporated in the ROC arises on the high seas or in a territory that is not subject to any state's jurisdiction, or when the location of the occurrence cannot definitely be established as being part of the territory of any state; (c) Any marine occurrence of a ship registered in the ROC, operated by a shipping company incorporated in the ROC, designed or manufactured by the ROC arises outside the territory of the ROC, the investigation organization of the state of occurrence does not intend to conduct the investigation or delegate the conducting of the investigation to the TTSB.

This report will hereafter describe the scope of major marine occurrence, the classification of major marine occurrence, statistics of the marine occurrence investigation, and the progress of the implementation of Actions Plans of the marine transportation Safety Recommendations.

4.1 Scope of the major marine occurrence

Major marine occurrence: means a very serious marine casualty and marine casualty.

- (1) Very serious marine casualty: means an undeliberate act that has resulted in any of the following which has occurred directly in connection with the operations of a civil ship or 4 public ship:
 - (a) The death of a person;
 - (b) The total loss of a ship;
 - (c) Severe damage to the environment and is found necessary to be investigated by the TTSB.
- (2) Marine casualty: refers to any occurrence indicated below to a civil ship or public ship during operation in which a marine casualty nearly occurred, and is found

necessary to be investigated by the TTSB.

- (a) Serious injuries to ten persons or more;
- (b) The loss of a person from a ship;
- (c) The ship is abandoned or missing;
- (d) A crew member whose duties are directly related to the safe operation of the ship is unable to perform their duties as a result of a physical incapacitation which poses a threat to the safety of persons, property or the environment;
- (e) The ship sustains a total failure of the navigation equipment that poses a threat to the safety of any person, property or the environment;
- (f) Situations that require emergency measures to avoid marine casualty;
- (g) The ship sinks, capsizes, founders, goes aground, is involved in a collision, or sustains a fire or an explosion;
- (h) The ship sustains all or part of the ship's cargo shifts, falls overboard, or liquefies that affects its seaworthiness;
- (i) There is an occurrence release on board or from the ship consisting of a quantity of dangerous goods or an emission of radiation that is greater than the quantity or emission levels specified in the notification standards of the IMDG 5 Code (International Maritime Dangerous Goods Code);
- (j) Marine occurrence results in a residual oil leakage with the amount between one hundred tons and seven hundred tons;
- (k) The ship or waterway infrastructure sustains substantial damages, or sufficient evidence indicating that the ship or waterway infrastructure is substantially damaged.

4.2 The classification of major marine occurrence

In order to allocate the resource of manpower and equipment effectively, TTSB divide the major marine occurrence into three different classifications, the classification and definition of major marine occurrence are defined as follow.

Class 1

Refers to occurrence associated with the operation of a ship other than a fishing vessel that cause deaths, total loss of vessel, or have a significant effect on the environment and for which an investigation is deemed necessary by the Taiwan Transportation Safety Board (TTSB), or that are deemed by the TTSB to significantly endanger marine safety. The investigation report must conform to the full report format.

Class 2

Refers to occurrence that occur during the operation of a fishing vessel and conform to “very serious marine casualty pertaining to the scope of major marine occurrence,” or that occur during the operation of a vessel and conform to “marine casualty pertaining to the scope of major marine occurrence,” for which the investigation is deemed necessary by the TTSB. The investigation report must conform to the simplified report format.

Class 3

Refers to occurrence that occur during the operation of a vessel and conform to “the scope of major marine occurrence,” the evidence of which cannot be collected, analyzed, and investigated because of a lack of sufficient factual information, lost evidence, or unavailable evidence. Closure of such occurrence investigation shall be conducted by an initial report at the Board meeting and then archiving the investigation report.

4.3 Statistics of marine occurrence investigation

A total of 284 marine occurrence notifications were received from each agencies, media and ship companies from 1 Aug. 2019 to 31 Dec. 2020. There were 89 occurrences classified as major marine occurrences that needed to be investigated, the percentage for reported occurrences and major marine occurrences needed to be investigated is 31.34%. Figure 74 shows the number of investigations in 2019 and 2020 respectively.

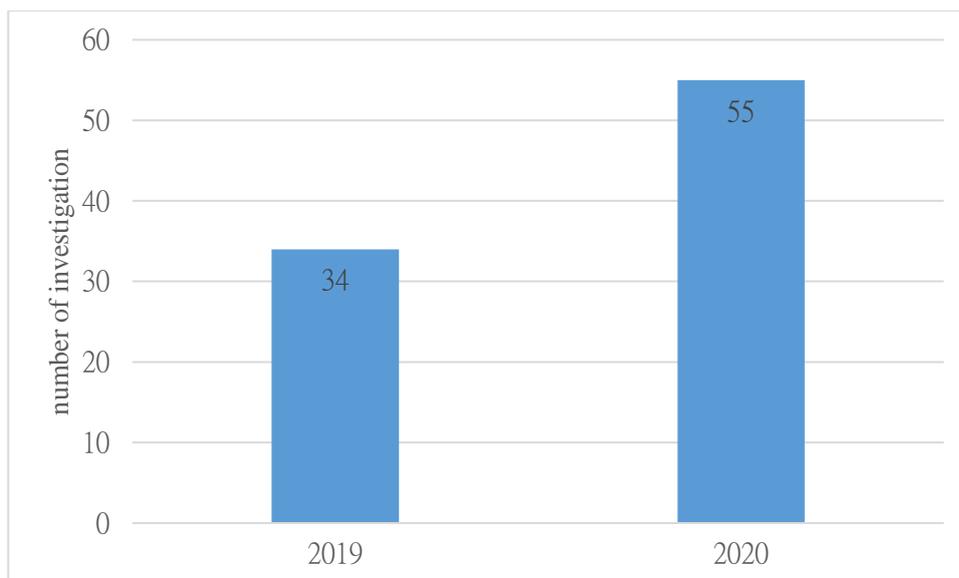


Figure 74. The number of investigation in 2019 and 2020.

Table 24 is the numbers of classification for the investigation from 2019 to 2020. There were 21 Class 3 investigations and 39 cases in 2020. Class 1 investigations of 2019 and 2020 were 3 and 1 respectively.

Table 24. The number of the classification for investigation

Classification	Numbers of investigation, 2019	Numbers of investigation, 2020
Class 1	3	1
Class 2	10	15
Class 3	21	39
Total	34	55

Table 25 shows the numbers of occurrences under investigation. There were 5 cases under investigation in 2019 and 15 in 2020. As a result, total 20 cases were continuing under investigation in 2021; Regarding the marine occurrence investigation, no interim occurrence investigation report was released.

Table 25. The number of the occurrence under investigating

2019 under investigation	2020 under investigation	2021 constantly investigating ²	Interim investigation report released
5	15	20	0

There were 10 cases caused by fire/explosion in 2019 and 13 in 2020, which were

² The number of 2021 constantly investigating is sum up by the number of occurrences under investigating 2019 and 2020.

the most common casualty type of occurrence investigation (see Table 26).

Table 26. The casualty type of investigation

Year	Grounding	Missing	Fire/Explosion	Collision	Occupational accident	Machinery damage	Flooding/foundering	Capsizing/listing	Other
2019	3	3	10	7	2	1	6	1	1
2020	4	11	13	13	2	0	0	8	4
total	7	14	23	20	4	1	6	9	5

Figure 75 shows the location of major marine occurrences investigated by TTSB. Most occurrences happened at Taiwan coastal area, and few in the Indian Ocean and Pacific Ocean.

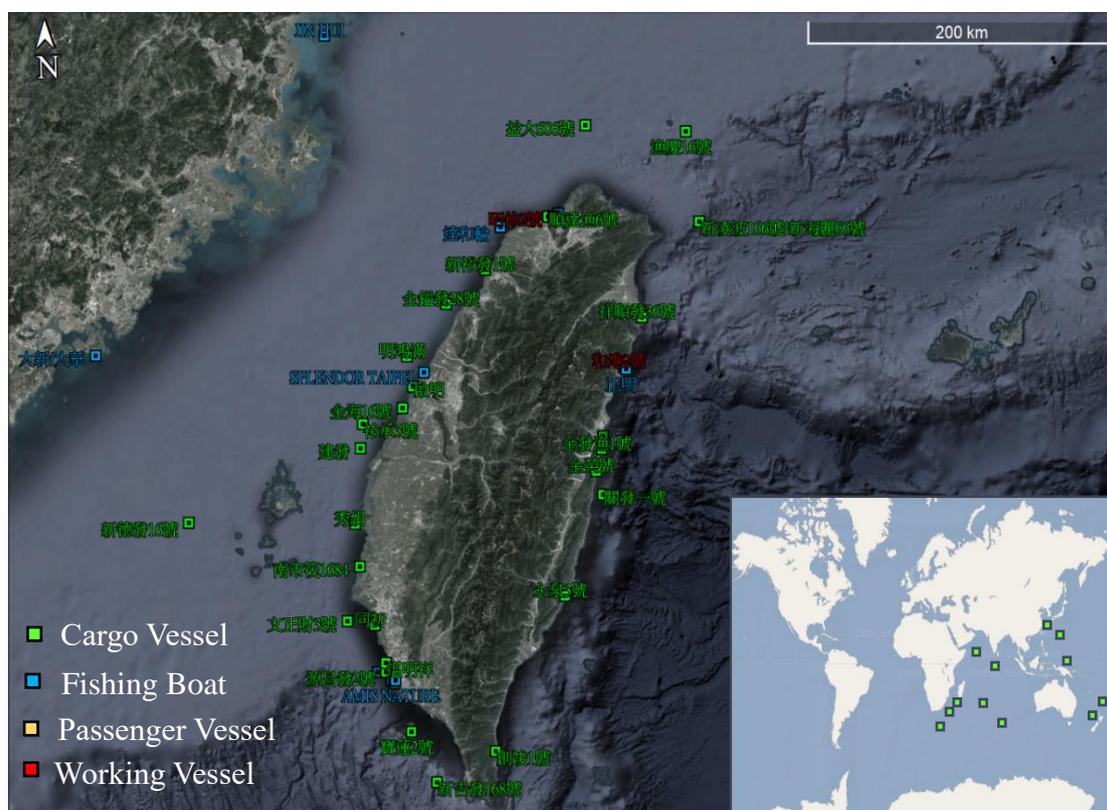


Figure 75. The location of major marine occurrences investigated by TTSB

4.4 Implementation Progress of Actions Plans of Marine Transportation Safety Recommendations

According to Article 27 of the Transportation Occurrences Investigation Act, “The government authorities concerned shall submit a management report to the Executive Yuan within 90 days after the receipt of the transportation occurrence investigation report and send a copy to the TTSB. The management report shall contain detailed and concrete implementation plans in response to the transportation safety

recommendations that are considered practicable. In response to the recommendations considered impracticable, detailed reasons shall be provided. The execution of the detailed implementation plans, mentioned in Paragraph 1, shall be supervised by the Executive Yuan and tracked by the TTSB.” Upon being notified by government-affiliated agencies and receiving copies of their action plans, the TTSB shall categorize the action plans according to their implementation status. The TTSB would suggest the Executive Yuan accept action plans with concrete and actionable tasks that have been completed and closed the case. For action plans that fail to achieve the improvement targets, the TTSB would suggest the Executive Yuan reject these plans, and the affiliated agencies will be asked to resubmit a plan or supplemental information. If the action plan has a longer schedule or must be completed in stages, it is suggested to be overseen by the Executive Yuan and its status tracked every six months until the improvements are completed and the case can be closed.

From 1st August 2019 to 31st December 2020, 18 of 26 marine safety recommendations were still waiting for the reply from the government authorities concerned. Additionally, 5 recommendations were under supervised by the Executive Yuan and 3 recommendations were closed. The percentage of the implementation progress of actions plans of the transportation safety recommendations is shown in Figure 76.

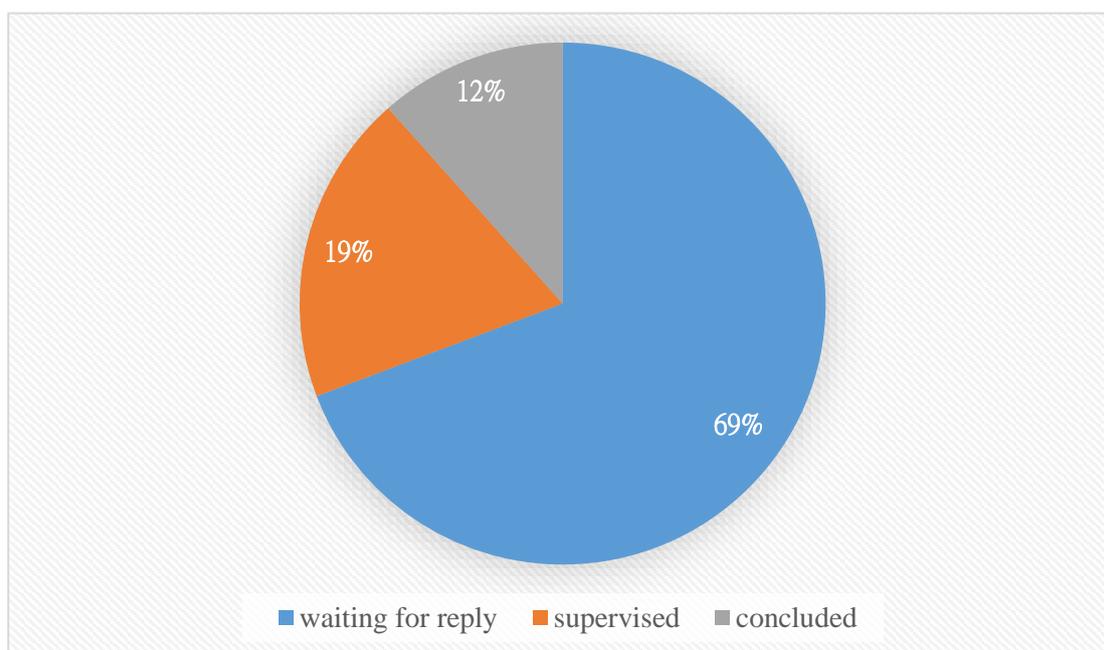


Figure 76. The percentage of the implementation progress of actions plans on the marine transportation safety recommendations

Appendix 1 Terminology definitions

According to IMO “Casualty Investigation Code” in its updated version and IMO Circular MSC-MEPC.3/Circ.4/Rev.1

Marine Accident means any marine casualty or marine incident. An accident does not include a deliberate act or omission, with the intention to cause harm to the safety of a ship, an individual or the environment.

Accidents may be classified (in order of severity) as follows:

- **Very Serious Marine Casualty**
- **Marine Casualty**
- **Marine Incident**

Marine casualty means an event, or a sequence of events, that has resulted in any of the following which has occurred directly in connection with the operations of a ship:

- serious injury to, a person
- the loss of a person from a ship
- the loss, presumed loss or abandonment of a ship
- material damage to a ship
- the stranding or disabling of a ship, or the involvement of a ship in a collision;
- material damage to marine infrastructure external to a ship, that could seriously endanger the safety of the ship, another ship or an individual
- the potential for severe damage to the environment, brought about by the damage of a ship or ships.

Very serious marine casualty means a marine casualty involving:

- the total loss of the ship or
- a death or
- severe damage to the environment.

Marine incident means an event, or sequence of events, other than a marine casualty, which has occurred directly in connection with the operations of a ship that endangered, or, if not corrected, would endanger the safety of the ship, its occupants or any other person or the environment. Marine incidents include hazardous incidents and near misses.

Marine casualty classification

1. **Collision:** striking or being struck by another ship (regardless of whether under way, anchored or moored).
2. **Stranding or grounding:** being aground, or hitting/touching shore or sea bottom or underwater objects (wrecks, etc.).
3. **Contact:** striking any fixed or floating object other than those included in Nos.1 or 2
4. **Fire or explosion**
5. **Hull failure or failure of watertight doors, etc.:** not caused by Nos.1 to 4
6. **Machinery damage:** not caused by Nos.1 to 5, and which necessitated towage or shore assistance environment.
7. **Damages to ship or equipment:** not caused or covered by Nos.1 to 6
8. **Capsizing or listing:** not caused by Nos.1 to 7
9. **Missing:** assumed lost
10. **Flooding/foundering**
11. **Occupational accidents**
12. **Others**
13. **Unknown**