



A comparative study on marina development and recreational boating in Perth, Auckland and Fukuoka

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1. Introduction

The great increase in demand for oceanic recreational activities in Japan has necessitated the construction of a great many marinas in the most efficient way. It has become important to collect precise data concerning how marina facilities and pleasure boats are being used when drawing up plans for this construction. As it has not been long since a first example of such a marina was built in Japan, the standard of Japanese technology used for this is presumed to be far lower than that of European and American technology, owing to lack of experience. Also, the author has to say that no accepted way of designing and constructing marinas has been made available in Japan so far.

For the purpose of determining the proper size and effective use of a marina in a medium-sized city with a population of about 1 to 2 million, he has conducted a comprehensive survey on marina facilities and pleasure boats in marinas which are closely linked to a nearby urban area, and then has counted the number of times each facility has been used; for example, in the neighborhood of both Perth, Western Australia and Auckland, New Zealand. A similar survey was also carried out in the urban region of Fukuoka, Japan, a city with roughly the same population as the two previously mentioned. The results of the latter survey have been compared with those of the former. Furthermore, the comparison offers a key to understanding the problems associated with improvement work of marina facilities in the urban region of Fukuoka in the future.

2. Procedures for Conducting a Survey

This survey consists of going to marinas and counting the number of mooring facilities by the seaside or riverside, where yachts and pleasure boats are being kept or put in dry storage in the urban region of each of the 3 cities mentioned above, and of counting the boats after they are sorted according to type. Cabin cruisers and sailing or power boats used for pleasure cruises are chosen as the subject for this survey. Excluded from this survey are small



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open-type boats such as dinghies, because they require no special space, where they can stop and be tied up, usually as in a harbor. In the case of Fukuoka, however, there are a lot of small open boats equipped with an outboard motor and Japanese-style boats without a cabin. Therefore, the total of those boats can be found especially in the added columns for small open-type boats in the tables.

3. Results of a Survey in the Urban Region of Perth

The survey was carried out from July 8, 1992 through August 14, 1992. Figures 1 and 2 show what area each of them has covered: both sides of the Swan River and marinas along the section of the seashore between Two Rocks in the north and Mandurah in the south, on which the Indian Ocean looks out.

(1) Marina facilities and number of berthing facilities

The tidal range in the port of Fremantle at the estuary of the Swan River is found to be relatively small: approximately 0.7 m. That gives rise to the application of more piled piers, but of less floating piers in the urban region of Perth. Those piers have few finger-like projections in directions at some angles to the main. The stern of most of the boats is moored by means of ropes at two piles. Also, the berth called a pen is a space in the harbor where a boat or yacht can moored and be tied up. What is called a "swing mooring" is a type of a one point mooring system used to hold boats at the mooring position by means of fixed anchors, and can be found, for example, in rivers or bays, with little influence due to waves.

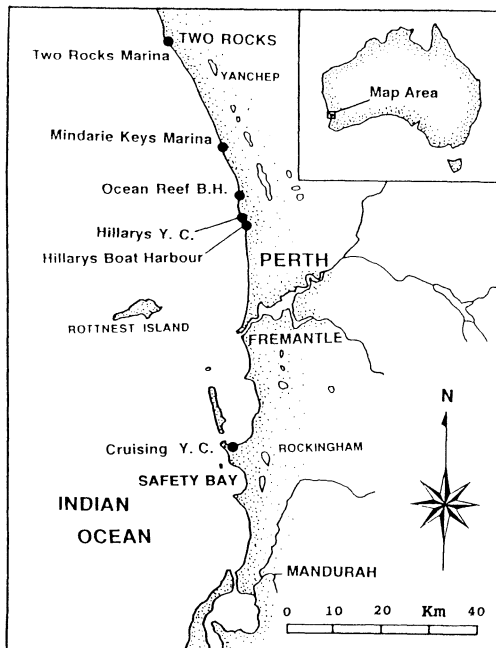


Figure 1 : Marinas and yacht clubs in the Perth urban region

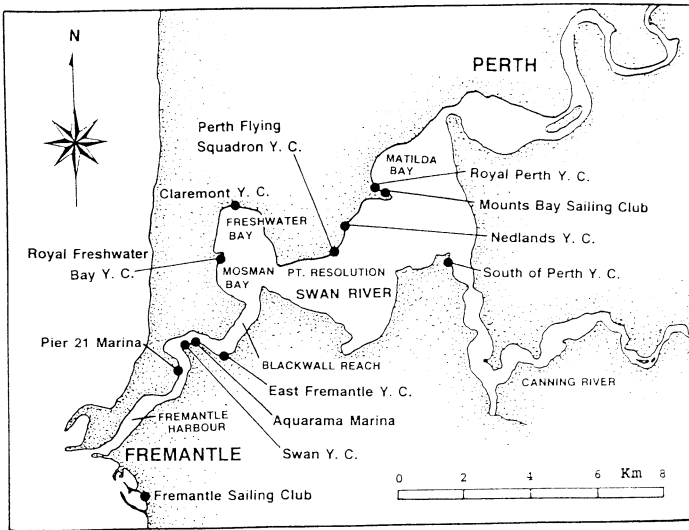


Figure 2 : Marinas and yacht clubs in the Perth urban region

There are a lot of yacht clubs adjacent to public and private marinas in the urban region of Perth. Each of those clubs may have mooring facilities of their own in a basin leased from the public office, as shown in Table 1 and 2. Most of them are located along the banks of the Swan River or at its estuary. The Fremantle Sailing Club is the biggest, and has 778 berths. Next is the South Perth Y.C., to the Royal Perth Y.C. and the Royal Freshwater Bay Y.C.. 12 of those yacht clubs have an average of about a thousand members.

The Hillarys Boat Harbor, which has 381 berths in total, is a publicly owned corporation while Mindarie Keys and Two Rocks Marina along the stretch of coastline of the Indian Ocean. Aquarama Marina and Pier 21 Marina on the banks of the Swan River are privately controlled. The number of berths for those yacht clubs and marinas is 3,259 and 988, respectively. 76.7% of such berths are found in the yacht clubs (as compared to the total of 4,247 berths). There are more pens (78.1%) but less swing moorings (4.5%) used to keep pleasure boats are moored. In addition, the pleasure boats put in dry storage amounts to 17.4%.

(2) Number of pleasure boats

Table 3 "The number of pleasure boats classified according to type as regards the marinas" shows that there are 1,462 cruisers (53.8%) and 1,249 motor boats (46.1%). Figures inside the parentheses of the table show the number of pleasure boats kept in dry storage. Table 4 shows that 167 cruisers (22.9%) and 563 motor boats (77.1%) are kept in storage in the marinas. Therefore, both types of boats total 730. This shows that slightly more cruisers are kept in storage in the yacht clubs, but to the contrary, more motor boats are being kept in the marinas. Table 5 shows that the number of pleasure boats moored in the rivers and at the seaside other than in the marinas and in the yacht clubs is found to be 372. Figure 3 shows that 1,834 cruisers and 1,979 motor boats are in the urban region of Perth. The total number of pleasure boats is found to be 3,813.



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Table 1 : Yacht clubs and number of berths in the Perth urban region

	Member	Pen	Swing	Dry S.	Total
Royal Perth Yacht Club	1600	346	0	80	426
Mounts Bay Sailing Club	455	30	0	0	30
Nedlands Yacht Club	620	10	10	140	160
Perth Flying Squadron Yacht Club	400	150	0	90	240
Claremont Yacht Club	447	168	5	19	192
Royal Freshwater Bay Yacht Club	1665	283	39	72	394
Fremantle Sailing Club	2500	632	6	140	778
Swan Yacht Club	1188	235	0	15	250
East Fremantle Yacht Club	1000	103	17	0	120
South of Perth Yacht Club	1400	362	30	50	442
Hillarys Yacht Club	659	112	0	5	117
Cruising Yacht Club	650	0	80	30	110
Total	12584	2431	187	641	3259

Table 2 : Marinas and number of berths in the Perth urban region

		Pen	Swing	Dry S.	Total
Two Rocks Marina	Private	44	7	0	51
Mindarie Keys Marina	Private	85	0	14	99
Hillarys Boat Harbour	Public	381	0	0	381
Pier 21 Marina	Private	170	0	32	202
Aquarama Marina	Private	207	0	48	255
Total		887	7	94	988

Table 3 : Number of pleasure boats in the Perth urban region
(Yacht clubs)

	Cruisers	Motor Boats	Total
Royal Perth Yacht Club	225 (41)	127 (22)	352 (63)
Mounts Bay Sailing Club	12 (0)	15 (0)	27 (0)
Nedlands Yacht Club	31 (13)	0 (0)	31 (13)
Perth Flying Squadron Yacht Club	77 (26)	99 (25)	176 (51)
Claremont Yacht Club	73 (5)	74 (2)	147 (7)
Royal Freshwater Bay Yacht Club	211 (78)	143 (5)	354 (83)
Fremantle Sailing Club	363 (42)	329 (95)	692 (137)
Swan Yacht Club	26 (0)	200 (15)	226 (15)
East Fremantle Yacht Club	52 (0)	64 (0)	116 (0)
South of Perth Yacht Club	265 (35)	109 (9)	374 (44)
Hillarys Yacht Club	39 (0)	46 (0)	85 (0)
Cruising Yacht Club	88 (58)	43 (20)	131 (78)
Total	1462 (298)	1249 (193)	2711 (491)

Table 4 : Number of pleasure boats in the Perth urban region (Marinas)

	Cruisers	Motor Boats	Total
Two Rocks Marina	10 (3)	55 (25)	65 (28)
Mindarie Keys Marina	19 (0)	18 (0)	37 (0)
Hillarys Boat Harbour	57 (0)	92 (0)	149 (0)
Pier 21 Marina	10 (1)	128 (21)	138 (22)
Aquarama Marina	16 (0)	183 (40)	199 (40)
Others (5)	55 (10)	87 (12)	142 (22)
Total	167 (14)	563 (98)	730 (112)

Table 5 : Number of pleasure boats in the Perth urban region (Rivers / Seaside)

	Cruisers	Motor Boats	Total
Matilda Bay / Pt. Resolution	40 (0)	12 (0)	52 (0)
Freshwater Bay / Mosman Bay	33 (0)	22 (0)	55 (0)
Blackwall Reach	80 (0)	52 (0)	132 (0)
Canning River	26 (0)	21 (0)	47 (0)
Swan River	12 (0)	23 (0)	35 (0)
Safety Bay	6 (0)	15 (0)	21 (0)
Mandurah	8 (0)	22 (0)	30 (0)
Total	205 (0)	167 (0)	372 (0)

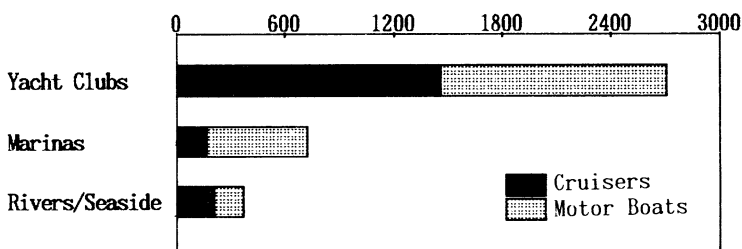


Figure 3 : Total number of pleasure boats in the Perth urban region

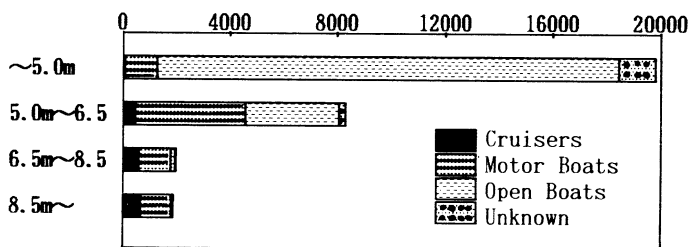


Figure 4 : Distribution of pleasure boats according to their types and length (Perth)

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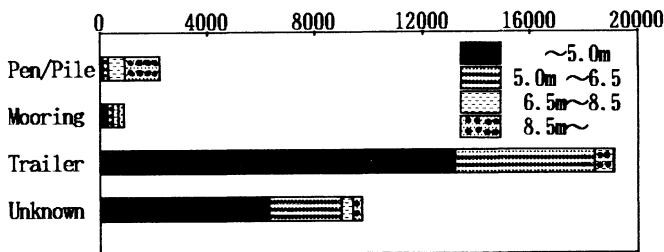


Figure 5 : Distribution of pleasure boats according to their forms of storage and length (Perth)

(3) Distribution of pleasure boats according to their types, forms of storage and length

Figures 4 and 5 show the distribution of pleasure boats according to their types, forms of storage and length based on the survey on the ones registered with the Dept. of Marine and Harbours, Western Australia in 1992 [Ref. 1]. Small open-type boats are the most popular type of pleasure boat in this survey, and account for 20,964 (65.2%), while the total of the registered ones comes to 32,152. The ones which are less than 5 meters in length amount to 19,885 (62.8%).

The home keeping is a general term for putting a pleasure boat in storage at home by carrying the boat by trailer for safekeeping rather than mooring the boat at sea. It is getting more and more popular, and has recently increased in number: 19,167 (59.6%). The result has also revealed that the number of these boats is generally greater than the number of cruisers and cabin motor boats moored in the yacht clubs and in the marinas in the urban region of Perth.

4. Results of a Survey in the Urban Region of Auckland

This survey was carried out from September 8 - 15, 1992. Figure 6 shows the area within which the survey was conducted for small harbours for pleasure boats, ranging from Cape Whangaparaoa to Beachlands along Hauraki Gulf in the urban region of Auckland. The mooring of pleasure boats is allowed only in the recreation zone designated in Auckland [Ref. 2].

(1) Marina facilities and number of berths

The tidal range in Auckland is very large: approximately 2.7 meters: therefore, pleasure boats moored at the piled pier can not be found. The method of mooring is available regarding three types: marina berth (a method of securing a pleasure boat by means of pontoons); pile mooring (a method of securing a pleasure boat to 2 or 4 piles by means of ropes); and the swing mooring. The first one is set in the marina facilities while the second and third are not only in the sea and rivers but also within the marinas. Table 6 shows that the marinas and boat harbours put together are seven in total. Westhaven Boat Harbour and Okahu Boat Harbour are under public management of the Ports of Auckland. The former is the biggest harbour with 1,590 berths in Auckland, while the latter is enclosed by permeable pile-type breakwaters and provided with swing moorings by which all boats are secured.

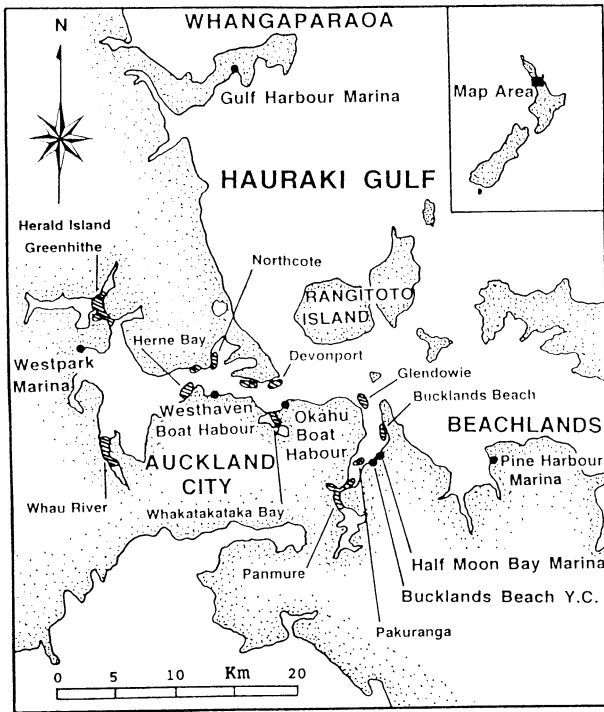


Figure 6 : Marinas and yacht clubs in the Auckland urban region

Table 6 : Number of berths in the Auckland urban region

		Pen	Pile	Swing	Total
Gulf Harbour Marina	Private	969	20	0	989
Westpark Marina	Private	590	0	0	590
Westhaven Boat Harbour	Public	1201	304	85	1590
Okahu Boat Harbour	Public	0	0	425	425
Half Moon Bay Marina	Private	500	0	0	500
Bucklands Beach Y.C	Yacht Club	100	0	0	100
Pine Harbour Marina	Private	555	0	0	555
Total		3915	324	510	4749

The four marinas which are under private management are: Gulf Harbour Marina; Westpark Marina; Half Moon Bay Marina; and Pine Harbour Marina. Each of these marinas has over 500 berths. Table 6 shows the relationship between the type of mooring and berths: 3,915 marina berths (82.4%); 324 pile moorings (6.8%); and 510 swing moorings (10.7%). The total number of berths in the marinas is 4,749.



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Table 7 : Number of pleasure boats in the Auckland urban region (Marinas)

	Cruisers	Motor Boats	Total
Gulf Harbour Marina	524 (53)	285 (20)	809 (73)
Westpark Marina	269 (21)	274 (24)	543 (45)
Westhaven Boat Harbour	717 (0)	366 (0)	1083 (0)
Okahu Boat Harbour	414 (115)	52 (18)	466 (133)
Half Moon Bay Marina	312 (87)	277 (28)	589 (115)
Bucklands Beach Y.C.	44 (0)	47 (0)	91 (0)
Pine Harbour Marina	292 (21)	233 (13)	525 (34)
Total	2572 (297)	1534 (103)	4106 (400)

Table 8 : Number of pleasure boats in the Auckland urban region (Rivers / Seaside)

	Cruisers	Motor Boats	Total
Herald Island / Greenhithe	225 (25)	27 (0)	252 (25)
Whau River	10 (0)	110 (30)	120 (30)
Herne Bay	24 (0)	5 (0)	29 (0)
Northcote	282 (22)	28 (3)	310 (25)
Devonport	64 (0)	15 (0)	79 (0)
Whakatakataka Bay	0 (0)	41 (0)	41 (0)
Glendowie	62 (0)	9 (0)	71 (0)
Bucklands Beach	149 (20)	27 (0)	176 (20)
Pakuranga	90 (0)	11 (0)	101 (0)
Panmure	222 (10)	114 (0)	336 (10)
Total	1128 (77)	387 (33)	1515 (110)

(2) Number of pleasure boats

Table 7 shows the number of pleasure boats kept in storage according to type: 2,572 cruisers (62.6%); and 1,534 motor boats (37.4%). The total number of those boats is 4,106. In Westhaven Boat Harbour, the author has, however, lost count of about 350 berths where pile moorings and swing moorings are used. The utilization rate of a total of 4,749 berths is found to be 93.8% in view of these figures. The figures in parentheses indicate that the number of pleasure boats kept in dry storage, inclusive of those boats in the dock yards accounts for 9.7% and is rather small. About 200 pleasure boats and about 20 charter boats which must have been in Oramus Marine at the eastern end of Westhaven Boat Harbour are not in the count.

Table 8 shows the number of pleasure boats classified according to moorings, excluding the marinas (the number of which includes part of the boats kept in dry storage) and type. 1,128 cruisers (74.5%) and 387 motor boats (25.5%) are moored at 10 places indicated in Fig. 6.. The total number of those boats is 1,515. It, therefore, follows that the total number of cruisers and motor boats in the urban region of Auckland is approximately 6,000. 75% of these are kept in storage in the marinas while the remaining 25% are kept in the rivers and at the seaside.

5. Results of a Survey in the Urban Region of Fukuoka

This survey was conducted from August 27-30, 1993. Figure 7 shows the study area within which the survey was conducted on small harbours for pleasure boats, from Tsuyazaki to Kafuri.

(1) Marina facilities and fishing ports

As shown in Table 9, there are 10 marinas of various sizes in the urban region of Fukuoka. Fukuoka Municipal Odo Yacht Harbour which is run by the city and Marinao (an abbreviated designation for Nishifukuoka Marina) have mooring facilities. In the other marinas, all pleasure boats are put in dry storage for safekeeping. In Japan pleasure boats are often moored in fishing ports. In the urban region of Fukuoka, Table 10 shows that such boats are moored primarily in 13 fishing ports.

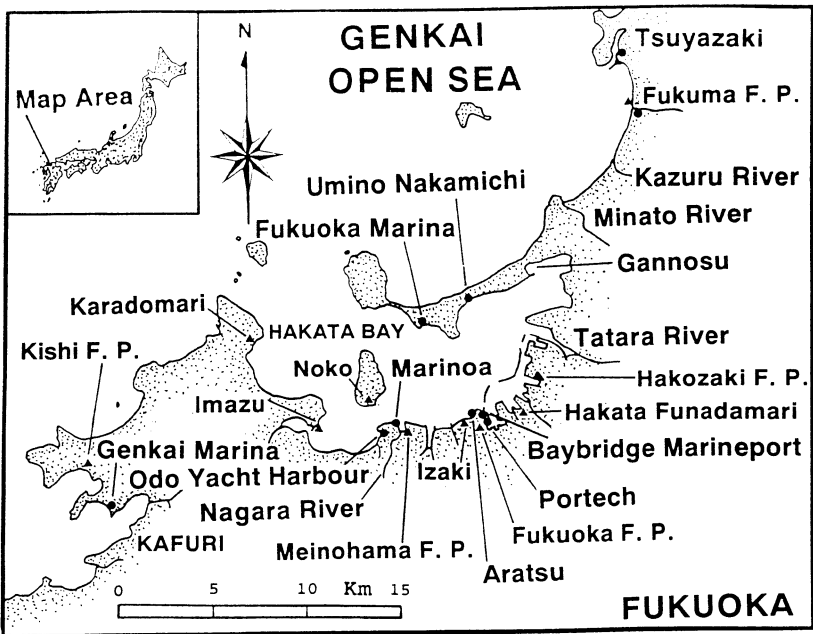


Figure 7 : Marinas and fishing ports in the Fukuoka urban region



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Table 9 : Number of pleasure boats in the Fukuoka urban region (Marinas)

	Cruisers	Motor Boats	Open Boats	Total
Tsuyazaki Marina	0 (0)	66 (66)	17 (17)	83 (83)
Fukuma Marina	0 (0)	34 (34)	13 (13)	47 (47)
Fukuoka Marina (Ohotake)	6 (6)	92 (92)	50 (50)	148 (148)
Umino Nakamichi Marina	25 (25)	157 (157)	9 (9)	191 (191)
Portech	1 (1)	19 (19)	4 (4)	24 (24)
Baybridge Marineport	0 (0)	22 (22)	5 (5)	27 (27)
Aratsu Ocean Sports Club	0 (0)	93 (93)	52 (52)	145 (145)
Marinoa	17 (11)	51 (37)	1 (1)	69 (49)
Odo Yacht Harbour	176 (0)	2 (0)	4 (0)	182 (0)
Genkai Marina	0 (0)	55 (55)	10 (10)	65 (65)
Total	225 (43)	591 (575)	165 (161)	981 (779)

Table 10 : Number of pleasure boats in the Fukuoka urban region (Fishing ports)

	Cruisers	Motor Boats	Open Boats	Total
Tsuyazaki Fishing Port	32 (0)	19 (0)	17 (0)	68 (0)
Fukuma Fishing Port	0 (0)	12 (0)	15 (0)	27 (0)
Hakozaki Fishing Port	37 (0)	102 (26)	35 (20)	174 (46)
Hakata Funadamari	0 (0)	14 (0)	6 (0)	20 (0)
Fukuoka Fishing Port	0 (0)	16 (0)	4 (0)	20 (0)
Izaki Fishing Port	0 (0)	16 (0)	3 (0)	19 (0)
Meinohama Fishing Port	4 (0)	9 (0)	2 (0)	15 (0)
Noko Fishing Port	4 (1)	11 (4)	1 (0)	16 (5)
Imazu Fishing Port	18 (0)	30 (14)	65 (8)	113 (22)
Karadomari Fishing Port	6 (0)	23 (0)	37 (0)	66 (0)
Kishi Fishing Port	3 (0)	74 (40)	36 (14)	113 (54)
Others (2)	1 (0)	10 (1)	2 (0)	13 (1)
Total	105 (1)	336 (85)	223 (42)	664 (128)

(2) Number of pleasure boats

Table 9 shows that the cruisers moored at Odo Yacht Harbour are the largest in number - 176 as well as the motor boats put in dry storage at Umino Nakamichi Marina - 157. Therefore, the motor boats put in dry storage at Fukuoka Marina, where there are many open boats as well, are 148. Furthermore, those put in dry storage at the Aratsu Ocean Sports Club that follow are 145 and so on.

Table 10 reveals that over 100 pleasure boats are moored or put in dry storage in 3 fishing ports: Hakozaki, Imazu and Kishi. Table 11 indicates the number of pleasure boats kept in storage in the sea and rivers. The ones moored in the Nagara River are the largest in number - 327, and the others moored or put in dry storage at 18 spots. The ones that are moored in the rivers and at the seaside, both of which are as usually shallow, are mostly motor boats and open boats other than cruisers.

Table 11 : Number of pleasure boats in the Fukuoka urban region (Rivers / Seaside)

	Cruisers	Motor Boats	Open Boats	Total
Tsuyazaki	0 (0)	57 (0)	53 (0)	110 (0)
Kazuru River	0 (0)	0 (0)	35 (0)	35 (0)
Minato River	0 (0)	1 (0)	62 (0)	63 (0)
Gannosu	4 (0)	2 (0)	29 (0)	35 (0)
Tatara River	0 (0)	15 (0)	33 (0)	48 (0)
Nagara River	2 (0)	172 (0)	153 (0)	327 (0)
Other Rivers (6)	0 (0)	8 (0)	38 (0)	46 (0)
Other Seaside (6)	1 (1)	13 (10)	55 (31)	69 (42)
Total	7 (1)	268 (10)	458 (31)	733 (42)

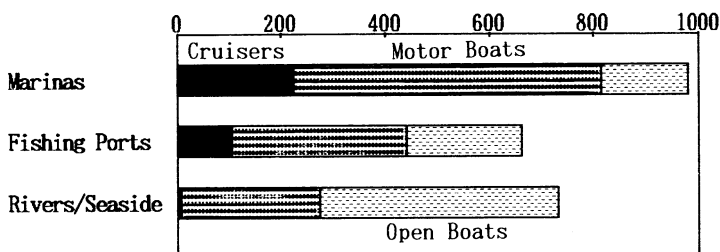


Figure 8 : Total number of pleasure boats in the Fukuoka urban region

Figure 8 shows the number of pleasure boats classified according to areas where pleasure boats are kept. 981 of the 2,378 pleasure boats are stored in the marinas (41.3%); 664 in the fishing ports (27.9%); 733 in the rivers and at the seaside (30.8%). Those boats are classified according to types: 337 cruisers (14.2%); 1,195 motor boats (50.2%); and 846 open boats (35.6%). It is also revealed that there are comparatively few cruisers. Although the ratio of the number of the ones kept in dry storage to the total number is not large (39.9%), the ratio of those kept in the marinas to the total number is found to be much larger-79.4%.

6. Comparison of Marina Data among the Three Cities

Perth, Auckland and Fukuoka have a nearby tranquil basin such as the Sawn River, Hauraki Gulf, Hakata Bay, which is suitable for using pleasure boats. Also, each of these cities has excellent natural conditions. The inhabitants can spend time cruising in the Indian Ocean, the South Pacific Ocean or the Genkai Open Sea, where there are several isolated islands that they can go to spend their holidays. Unfortunately, the way in which the marinas are improved and the frequency of times they are used in Fukuoka are entirely different from the others.



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(1) Scale of marinas

The average berth of a typical marina or yacht club in the urban region of Perth, Auckland and Fukuoka is found to be 250, 678 and 178, respectively. This reveals that the one obtained in Auckland is the greatest in number, a lot of the pleasure boats in storage are uniformly distributed throughout the yacht clubs in Perth and there are a lot of the small-scaled private marinas in Fukuoka.

(2) Places for storing pleasure boats

Figure 9 shows the number of pleasure boats classified by storage: marinas; rivers/seaside; fishing ports. The percentage of the boats kept in the marinas in the urban region of Perth, Auckland and Fukuoka are 90.2%, 73.0% and 41.3%, respectively. The lowest percentage is found in the urban region of Fukuoka. Therefore, the percentage of the boats moored in the marinas in the three cities is 82.5%, 90.3% and 20.6%, respectively. The greatest percentage of the boats in dry storage can be found by using the results provided previously in the urban region of Fukuoka. In the private marinas in Fukuoka the large motor boats that are over 30 ft in length and cruisers in dry storage are many.

(3) Number of pleasure boats

Perth, Auckland and Fukuoka have a population of 1.16 million, 850 thousand and 1.99 million in the urban region, respectively [Ref. 3]. The total number of the cruisers and cabin motor boats in each of the 3 regions is 3,813, 5,621 and 1,532 in the order mentioned. Figure 10 indicates that those 2 types of pleasure boats are 3,287, 6,613 and 770 per million of people. The ratio of the number of privately-owned pleasure boats to the population in the Fukuoka urban region equals 1 divided by 4.3 of that in the Perth urban region, and at the same time 1 divided by 8.6 of that in the Auckland urban region.

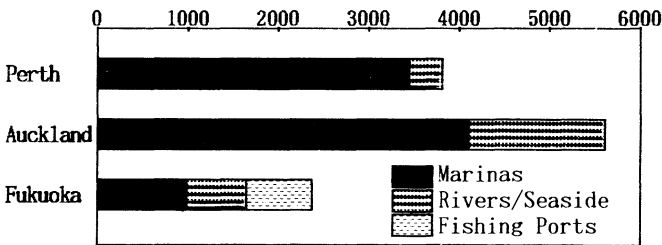


Figure 9 : Number of pleasure boats classified by storage in the three regions

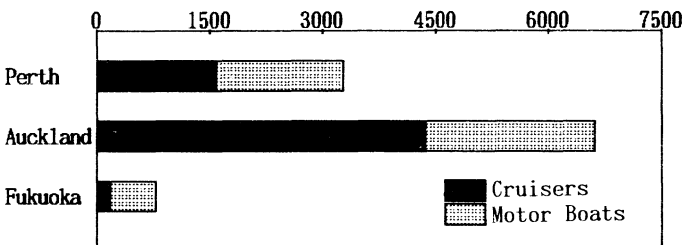


Figure 10 : Number of pleasure boats per million of people in the three regions



In addition, the number of the registered pleasure boats, including the open type and the small ones in each of the 3 urban regions is 32,152, 70,000 [Ref. 4] and 2,936. The Perth urban region, the Auckland urban region, and the Fukuoka urban region have a population of 36, 12 and 422 people per pleasure boat, respectively.

In other words, each of those regions has 27,700, 82,400, and 2,400 pleasure boats per million of people. This means that the total number of the pleasure boats, including the small ones in the Fukuoka urban region equals 1 divided by 11.5 of that in the Perth urban region and 1 divided by 34.3 of that in the Auckland urban region.

7. Conclusion

On the basis of the above, the future problems with the improvement of marinas in the Fukuoka urban region can be summarized as follows:

- (1) The Fukuoka urban region is badly lacking in berths for pleasure boats in comparison with its population;
- (2) The marinas are small private ones in which most of the pleasure boats are put in dry storage, and few of them in good condition;
- (3) Concerning the mooring of the pleasure boats in the fishing ports, the establishment of good ties with coastal fisheries is one of the important subjects that must be investigated in Japan;
- (4) It is necessary to take drastic measures to provide the least expensive landing anchorage for small boats to be moored along the seaside and rivers.

As coastal fishing is so prevalent in Japan, the serious and difficult problem is that boating will not get in the way of coastal fishing and have to coexist in peace regarding violent typhoons and strong seasonal winds. As the demand for ocean recreation is expected to increase in future, and the planning of many more marinas needs to be carried out.

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References

1. Dept. of Marine and Harbours W.A.: Private Boat Postcode Report, 1992.
2. Waitemata Harbour Maritime Planning Authority: Waitemata Maritime Planning Scheme, Section 5.5, pp.1-15, 1987.
3. United Nations: Demographic Yearbook, pp.260-303, 1990.
4. Ports of Auckland: Westhaven Boat Harbour, 1982.