Some Marine Transport Concerns

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Marine transportation is important because of the archipelagic nature of the Philippines, its strategic location in Southeast Asia and the contribution of the sector's different components to the economy. Safety at sea is of critical concern, given the numerous disasters that have occurred on Philippine waters. While the policy framework is adequately addressed by existing government agencies, some glaring gaps such as the need to process and improve available information on sea states regularly, the seaworthiness of outrigger boats or *bancas*, and the implications of the preference of Filipino crew for work overseas, among other issues, are discussed in the paper.

Marine transportation is well established as a means of travel and cargo transport between the islands of the Philippine archipelago. As much as 90 percent of all cargo is reported to be sea-borne with the remainder divided between air and land modes of travel. The gross domestic products of the various regions are directly proportional to the volume of cargo shipped by sea. Most of the major cities such as Manila, Cebu, Iloilo and Davao are situated close to the sea, having their origins as sea ports during the Spanish or American periods. But long before the colonial era, areas of trade flourished, aided by natural harbors and favorable sites for the ex-

change of goods. The importance of marine transportation for the country has been relatively understated, with the sector coming to prominence only when disasters at sea occur, prompting calls either for stricter implementation of existing rules or for outright punishment of the transportation agent, be this the shipowner, crew or even the relevant enforcement agencies.

SOME HISTORY

Excavations in Butuan City have unearthed 12 vessel artifacts capable of undertaking long ocean voyages, with the carbon dating process establishing these artifacts to be from the 8th century AD. Both legends and historical accounts describe our islands as having been settled by peoples from other parts of Asia, arriving at our shores by sea. Ethnographers note the similarities in language among the Southeast Asian peoples. Archeological artifacts point to common traditions between the peoples of Taiwan, Southeast Asia and the Philippines. Specific artifacts such as the *Manunggul* burial jar found in Palawan with a cover shaped like a boat and two human figures paddling atop is cited as proof of a common widespread culture throughout the mentioned areas. The features of this artifact including the type of boat, placement of the arms and facial expressions have also been found in various artwork and on other artifacts throughout the region (Zayas, 1998).

The Spaniards noted the navigational skills of Filipinos, particularly the Bisaya who used a compass such as that used by the Malays and Chinese. Sailing techniques employed by Malayo-Polynesian peoples were found among the early Filipinos. There is also growing evidence that the Micronesian Islands were peopled by the ancestors of the Filipinos because of similarities in rice culture, betel nut chewing and *tuba* or coconut wine production. With the coming of the Spaniards, the native boat, the *Karakao*, was transformed into a warship, with *lantakas* or small bronze cannons on both ends. This early use as a gun platform and a speedy craft to overtake enemy vessels gives testimony of its excellence.

After the capture of a Moro in Butuan, Legaspi noted that he was "*...a most experienced man who had much knowledge, not only of matters concerning these Filipinas Islands, but those of Maluco, Borney, Malaca, Jaba, India and China, where he had*

had much experience in navigation and trade." (Blair & Robertson, 1973). Such navigational skill would have been developed through a tradition of constant voyaging and exploration when seasonal winds were favorable, literally blowing people from one island to another.

Popular stories derived from oral histories describe the settling of 12 datus somewhere in Panay where they purchased the lowland areas from the Aetas for the price of a golden hat or *salakot* and a golden necklace. Historical accounts of early Malay settlement of the islands also made frequent mention of ships called *balanghais* that transported *datus* or chiefs from the southern Malay islands to settle in the country. Today, the basic unit of Philippine government, the barangay, derives its name from these vessels which were already in use in the islands before the Spanish came.

During the Spanish era, galleons plying the Manila-Acapulco (Mexico) trade route were built in Philippine shipyards which boasted an availability of ship grade timber, trained craftsmen and a large labor pool. Filipinos were hired to crew for most of these ships, beginning a strong tradition of seafaring that continues to this day, with the Philippines supplying 16 percent of the world's crew requirements.

The foregoing indicate the sea-going nature and importance of marine transportation to Filipinos. However, recent disasters and incidents within Philippine waters strongly contrast with and somehow diminish the glories of such a tradition, reflecting the need to minimize, if not altogether prevent, further incidents.

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PASSENGER ROUTES

About 45 million passengers traveled the different routes of the islands in 1998, with travel lasting anywhere from a brief 10 minutes to more than 2 days from port to port or from landing to landing, utilizing ferryboats or large ships ranging from dilapidated wooden hulls to new fast ferries and Superferries. Most of the routes

are within the archipelagic seas where the waters are relatively calm because of the protection afforded by the many islands. Most of these voyages begun and ended in the major cities where the major ports are located. These major routes are also where most adverse incidents occurred (Figure 1)

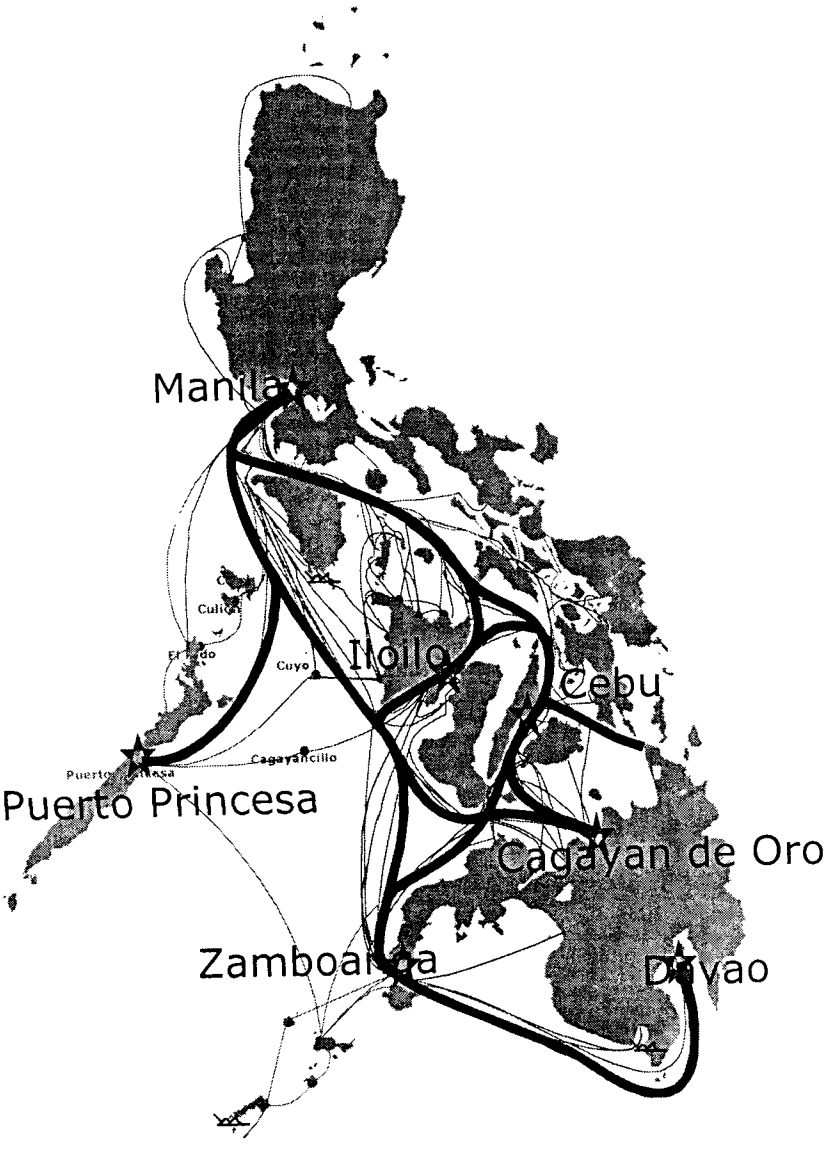


Figure 1.
Major shipping routes of the Philippines.

Accommodations on the larger well-served routes are relatively more comfortable with cruise ship-like berths providing amenities and services rivalling those provided by hotels on land. On board comfort for shorter routes however, except for those serviced by fastcraft, are relatively spartan, offering only bunks or folding canvas beds for passenger comfort. Even shorter routes serviced by outrigger boats are strictly no-frills affairs, with only shared benches for accommodation.

The beginning and end of classes, holidays such as Holy Week, All Saints Day and Christmas are the peak times for passenger traffic. These are also the times when the highest casualties for disasters at sea are recorded. The larger shipping lines such as WG&A, Negros Navigation and Sulpicio Lines serve the major routes while the shorter routes are served by individual companies running ships and vessels in varying degrees of seaworthiness. Classification Society Rules with strict guidelines for operation cover all ships above 500 gross tons while those below 500 gross tons are covered by Philippine Merchant Marine Rules and Regulations. However, no standards have been set for the construction, crewing and operation of craft weighing less than 3 gross tons.

For now, Philippine ports are simply embarkation/disembarkation points where passengers transfer from one mode of transport to another. However, it has long been pointed out that a Roll-On Roll-Off system (or RORO) wherein a family in Manila can drive their car up a ferry, travel with their car on the boat and simply drive off when they reach Cebu or any other destination would be more efficient. A refrigerated cargo truck carrying vegetables from Baguio could also get on a RORO ferry and disembark in Cebu; the same refrigerated truck can then return to Manila, carrying fish from Cebu for Manila's markets. The RORO system is thus seen to minimize the time and hassle of terminal waits for car owners and to be more convenient for cargo carriers who do not have to deal with intermediate transfers of cargo. An added benefit for consumers would be in the freshness of produce because of minimal handling during transport.

While it is unfortunate that the RORO system could displace several entities in the transport business who depend on hauling passengers and cargo to and from the ports, the RORO system has proven most efficient in other settings and is a standard feature in multi-mode transport systems in developed countries. Consid-

erable discussion of and some groundwork has been done on the development of a Western Philippine highway consisting of ROROs and highways to complement the existing Philippine Highway on the eastern side of the country connecting Luzon to Mindanao. This would open up more options for mode of transport, resulting in the better distribution of goods throughout the country. Currently, for example, imported corn is much cheaper for hog raisers in Luzon than corn produced locally because of high transportation costs.

Travel by sea could be reduced if parts of the journey were through land, thus reducing exposure to dangerous sea states occurring at specific times of the year. RORO ferries, built large to accommodate vehicles, would ensure safer travel over a wide range of sea conditions. The larger financial investment in a RORO system would also force operators and regulators to implement and more strictly enforce safety rules and regulations to avoid catastrophic disasters.

MARITIME INCIDENTS

The Philippines is featured in the Guiness Book of World Records as having suffered the highest number of casualties in an accident at sea, during peacetime, with the Dona Paz incident in 1987. The official count of fatalities was reported at 1,840, although unofficial counts estimate the number of those lost to be as high as 4,341. But whether we go with the official or unofficial tallies, the Dona Paz tragedy remains the world's worst accident at sea in terms of human deaths; the Mont Blanc and Imo collision at Halifax Harbor in 1916 is listed in second place with 1,600 casualties, including those deaths that occurred on land from the explosion and resulting fire. (Table 1).

Table 1. Disasters at sea with the world's highest casualties.

Ship/Nationality	Date	Location	Deaths
* Wilheim Gustloff (German refugee ship)	30 Jan 1945	Baltic NNE of Leba	6000 to 8000
* Goya (/German Navy troop/ refugee ship)	16-17 Apr 1945	Baltic near Hela -	7000
* [Chinese army evacuation ship]	Nov 1948		6000
* Junyo Maru (Japanese Navy prisoner ship)	18 Sep 1944	off Sumatra	5620
* Toyama Maru (Japanese Navy transport)	29 Jun 1944	bound for Okinawa	5400
* Cap Arcona (German refugee ship)	03 May 1945	Lubeck Bay	5000+/-
Dona Paz [Philippine]	**20 Dec 1987**	**Tablas Strait**	**4341**
* Lancastria (Cunard/Military troopship)	17 Jun 1940	off St. Nazaire	3500 to 6500
* General von Steuben (German military transport)	10 Feb 1945	off Stolpe Bank, Baltic	3500
* Provence (French Navy auxil' cruiser)	26 Feb 1916	off Kithira Island, Greece	3100
* Thielbek (German refugee ship)	03 May 1945	Lubeck Bay	2800+/-
* Neptunia (Italian military transport)	18 Sep 1941	off Tripoli	2500
* Oceania (Italian military transport)	18 Sep 1941	off Tripoli	2500
* Yamato (Japanese Navy battleship)	07 Apr 1945	SW of Kagoshima	2498
* Bismark (German Navy)	27 May 1941		2200
* Sinfra (German prisoner transport)	19 Oct 1943	north of Crete	2098

Ship/Nationality	Date	Location	Deaths
* Ural Maru (Japanese transport)	27 Sep 1944	240 km west of Masinlik, Philippines	2000
* Scharnhorst (German Navy)	26 Dec 1943	off North Cape of Norway	1964
* Rigel (German prisoner transport)	27 Nov 1944	north of Namsos	1833
* Arisan Maru (Japanese prisoner ship)	24 Oct 1944	South China Sea	1792
* Taiho (Japanese Navy aircraft carrier)	19 Jun 1944	west of Guam	1650
Mont Blanc [French], Imo [Belgian]	**06 Dec 1917**	**Halifax harbour**	**1600**
Titanic (WSL)	**15-16 Apr 1912**	**North Atlantic**	**1523**
Sultana [American]	**27 Apr 1865**	**on the Mississippi**	**1450 (up to 1900)**
* HMS Hood (RN)	21 May 1941	North Atlantic	1338
* Lusitania (Cunard)	07 May 1915		1198
Toya Maru [Japanese]	**26 Sep 1954**		**1172**
* Kiangya [Chinese]	03 Dec 1948 explosion (probably mine),		
Estonia [Estonian]	**28 Sep 1994**	**Baltic Sea**	**1049**
General Slocum [American]	**15 Jun 1904 burned,**	**New York City**	**1030**
* HMS Invincible (RN)	June 1916		1026
Empress of Ireland (CP)	**29 May 1914**	**St. Lawrence River**	**1014**

*Notes: War time or military based incidents are marked with an * while Passenger ships sunk during peace time are shown in bold fonts*

References: Lloyd's 1986; World Book 1993

Since 1987, there have been several ferry disasters in the Philippines including the following:

1. MV Doña Marilyn:	(a sister ship of the Doña Paz) sunk off Leyte on 24 October 1988: 254 deaths
2. MV Cebu City:	Collided with a Singaporean-registered freighter Kota Suria at the mouth of Manila Bay on 02 December 1994: 114 deaths
3. Kimelody Cristy	Fire south of Manila on 13 December 1995: 32 deaths
4. Gretchen 1	Overloaded ferry sunk off Central Philippines on 18 February 1996: 52 deaths
5. Princess of the Orient	Sunk during a typhoon at the mouth of Manila Bay on 20 September 1998: 150 deaths
6. Rosario 2	Caught fire off Central Philippines on 01 August 1999: 4 deaths
7. Asia-South Korea	Sunk after hitting reef off Northern Cebu on 23 December 1999: 42 deaths
8. Our Lady of Mediatrix	Caught fire from bombs rigged to three buses on board off the port of Ozamis City on 25 February 2000: 45 deaths
9. Anahada	Overloaded, sunk in Sulu waters on 12 April 2000: 143 deaths

The safety record of Philippine marine transport is of great concern because of the alarming frequency with which accidents occur as well as the magnitude of loss. Some conditions that contribute to increased risk at sea are poor safety support systems including the lack of warning systems and the inadequate number of rescue boats, lack of proper training of crew and the continued use of old ships with inadequate navigation and survival equipment. Then too, typhoons and prevailing Southwest and Northwest monsoons make travel by sea unsafe at certain times of the year. Some routes are inadequately served because of the inflexible schedules of the ferries or insufficient traffic, invariably leading to passenger overloads on

none too seaworthy vessels. Most ferries that remain in use, particularly the smaller boats that ply the shorter routes, are old, have wooden hulls and were purchased second hand, making sea travel on them all the more risky.

An average of 197 vessels per year were involved in maritime incidents from 1990 to 1999, with a total number of 109 confirmed casualties. It is unfortunate that the database of the Coast Guard covers incidents only from 1990, although it is enough to give us a clear idea of the state of marine transport in the country. Figure 2 indicates that boats capsizing because of adverse weather conditions comprise the largest group of accidents.

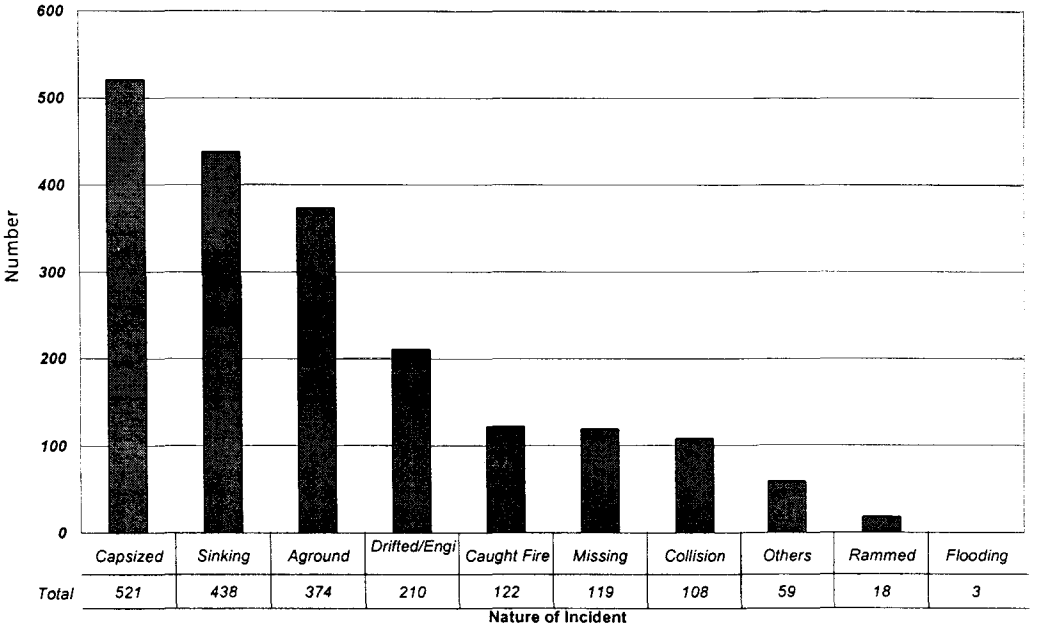


Figure 2.
Total Number of Incidents from 1990 to 1999 caused by adverse weather conditions

Most incidents occur near ports or harbors with major disasters occurring in the sea-lanes or while the vessels were in transit. This thus indicates the need to implement watchkeeping rules more strictly to ensure general crew competence while the ships are underway. That the majority of incidents occur near major ports also points to the aggregation of vessels in the port areas, a need for more efficient

systems of vessel traffic and the implementation of strict safety protocols when approaching ports and harbors. The inadequacy of our ports in providing safe harbors or shelters during typhoons are also implicated by the data.

The issuance of a National Maritime Safety Code in 2001 includes vessel safety parameters according to class sizes and specifies minimum crew qualifications. A significant development is the requirement for the classification of vessels 500 gross tons and above, thus greatly contributing to safety and disaster prevention while at sea.

The Maritime Industry Authority is mandated to establish policy guidelines and to issue all necessary administrative orders regarding implementation. More than adequate administrative orders have already been issued on safety, including AO number 143: "Rules and regulations to implement the International Safety Management (ISM) Code in domestic shipping"; AO number 148: "Amendments to Chapter XVIII of the Philippine Merchant Marine Rules and Regulations (PMMRR) 1997 on minimum safe manning for ships in the domestic trade"; AO number 154: "Reiteration of safety related policies/guidelines/rules and regulations for guidance and strict compliance"; AO number 159: "Adoption of a National Safety Management Code and Providing Rules and Regulations for its implementation in the Domestic Shipping". But while these rules and regulations already do much to ensure safety at sea, gaps remain which are only partially addressed by the existing issuances of MARINA and other related agencies.

WEATHER PREDICTION

Most reports of vessel capsizing occur in rough sea states or because of wave heights wrought by severe weather disturbances. Most capsizing and sinking incidents between 1990 to 1999, particularly involving smaller craft, occurred during typhoons. Typhoon Norming in 1998 was by far the most destructive, capsizing a record 82 small craft, the highest on record. (Figure 3).

Larger passenger vessels, big commercial fishing boats and cargo ships have weather faxes that receive weather plots regularly. But such information is not available to smaller vessels, including the more numerous motorized *bancas*. Some

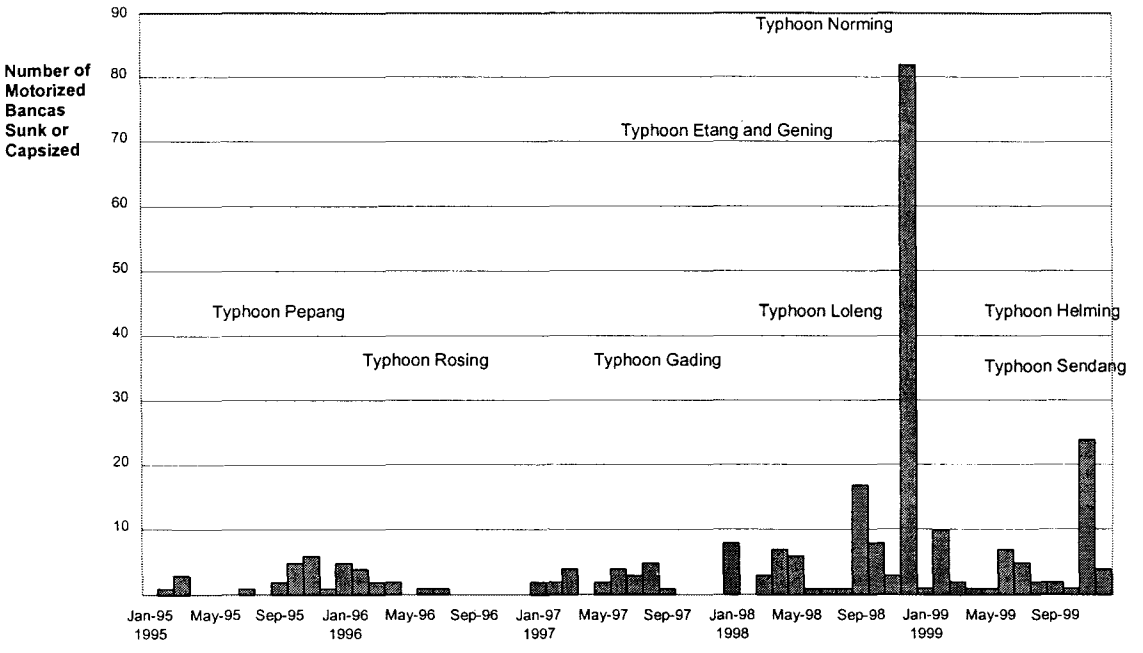


FIGURE 3.
Most capsizing incidents occurred during strong typhoons from 1990 to 1999.
References: Philippine Coast Guard Records, 1990-1999

mechanism must therefore be developed to enable remote coastal communities at risk as well as travelers to access critical information regarding weather conditions prior to their journey for better decision-making.

The most common measure for safety is wave height which is used to predict what sea conditions will be within a few hours. This is done in coordination with the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) which monitors wind speed on an almost daily basis through its meteorological stations all over the islands. Wave heights can then be calculated from the direction and speed of the winds and geographical area and rated according to existing standards such as the Beaufort Wind Scale which indicates wave heights for corresponding wind speeds and scale ratings from 1 to 10, from the very calm to the very rough. In advisory warnings, the rating system is simplified to 4 signals to be similar to the typhoon warning system. This rating system is used during ty-

phoons and at the peak of the Southwest and Northeast monsoons which commonly bring high sea waves.

Ideally, TV or radio weather reports should include wave heights with the rating system in any advisory warning to vessels of varying sizes. Presently, the Coast Guard prohibits ships of a certain size from sailing only during typhoons, but there may be instances when strong winds, in the absence of a typhoon in a particular area, may whip up waves of disastrous heights. It was such weather conditions which led to the *Gretchen* and *Anahada* disasters (refer to Table 1).

Information on wave height is regularly broadcast in more developed countries such as Japan and the United States. These warnings are in terms of small craft advisories where vessels up to a certain size are warned against setting sail. Weather reports can also be made more specific for regional broadcasts to local routes and fishing grounds. Carried by the national networks, such broadcasts would be useful on a regional or on a shipping lane basis. Such information can also be carried in newspapers and weekly magazines.

At the very least, marine environment subjects included in our school curricula will instill awareness of the dangers associated with particular sea conditions.

Campaigns utilizing posters and leaflets among other forms, can be used to educate the public regarding the warning system. A long term approach to and investment in maritime safety and in the marine environment would include subjects such as oceanography and meteorology in the high school curricula. Being an archipelago, it is critical that we know more about our marine waters.

At the very least, marine environment subjects included in our school curricula will instill awareness of the dangers associated with particular sea conditions. And since much of our trade and travel is done on the seas, knowing about the sea state will aid in the prevention of accidents and untoward incidents at sea by informing the shipowners and passengers on prevailing conditions beforehand.

A policy should therefore be instituted to make information regarding the sea state and equivalent craft limits a regular feature of weather reports, especially during the typhoon season or during the months of heightened monsoon activity from June to November.

CREW, VESSEL CONDITIONS AND MANAGEMENT

The facility to communicate in English and good training and aptitude on board are among the major reasons for the great demand for Filipino sailors on merchant fleets. However, this preference for Filipino crew members has adversely affected the domestic shipping industry where the wages are considerably below international rates. The best and brightest products of Philippine maritime schools readily find work abroad, leaving the domestic fleet to choose from a considerably diminished pool of qualified graduates. Maritime incidents recorded by the Philippine Coast Guard involving rounding, sinking, collision, fire, capsizing, missing vessels and engine trouble attribute the greater majority of these incidents to a lack of crew skill, attitudes and competence as well as to possible rule violations or vessel mismanagement (NMSC, 1996).

While the licensing requirements of MARINA are well established, the large discrepancy in wages can only contribute to less capable manning resources for our domestic fleet. Unfortunately, this is a situation which can only be remedied by offering more competitive rates to those offered by foreign fleets, which may not be possible, given our current economic difficulties.

One way to improve this condition is through constant training requirements and the strict implementation of STCW 95 (Standards for Training Certification and Watchkeeping) required by the International Maritime Organization (IMO) for the world's fleets. This would ensure proper training for domestic and foreign crew members.

The Philippine Merchant Marine Rules and Regulations (PMMRR) of 1997 cover the requirements for ship safety and include manning regulations. But the fact that many unfortunate incidents implicate crew errors or inadequacies draws attention to the aspect of implementation. Then too, shipowners, crew members or

officers responsible for disasters are seldom caught or punished. Sulpicio Lines was immediately suspended after the Princess of the Orient incident which resulted in 150 deaths in 1998 but was back in operation after a week or so. This highlights the need to correct flaws in the implementation of rules and regulations so these can be respected and followed.

63% of medium and larger vessel types weigh 3 to 99 gross tons; 27% of these vessels are from 100 to 499 gross tons while the remaining 10% weigh more than 500 gross tons. The merchant fleet has 22% of passenger ferries, general cargo of 43 percent and barges for 9 percent. 70 % of the country's merchant fleet is less than 15 years old while some of the older ships with a gross tonnage of 2000 are over 20 years old. Vessel conditions for the larger commercial operations have improved considerably in terms of vessel age, machinery and equipment, evidencing the separation of passenger operations from crewing functions by most shipping companies. Most second hand passenger liners had their first lives as cruise ships and were built for hotel type management rather than crew-managed passenger service. This has made for relatively better service on board and encouraged competition among liners serving the same routes.

Unfortunately, the safety preparedness of passengers on board has not similarly improved. While it is mandatory for airline passengers to listen to safety precautions regarding the use of life vests and location of exits, there are no equivalent briefings on board passenger ships. Fire, for instance, is a frightening possibility in the larger passenger ships; exit location briefings, life vest donning procedures and lifeboat assignment briefings as well as fire drills should be regularly conducted to ensure appropriate passenger and crew response.

Earlier, it was noted that most accidents occur during peak travel times such as holidays and vacation periods. Overloading has been blamed in many of these cases, as passengers frantically attempting to get home. Essentially a scheduling problem, shipping companies should schedule more trips to accommodate the increase in passengers rather than forcing the overflow into their regular schedules. In this case, long term scheduling and proper anticipation using optimization approaches and models can help in minimizing difficulties, especially during peak seasons. How-

ever, increasing the frequency of trips during peak times is a partial solution which must be coupled with improved safety practices.

Smaller operations, including shorter routes between non-major ports, are serviced by older ships including wooden (comprising 57% of all ships) and larger motorized outrigger boats (Marina, 1998). Several incidents and disasters including the major capsizing incidents involved crafts in this category, serving notice of the need to more strictly implement and monitor safety rules and regulations governing lifesaving equipment and procedures as well as the procurement of a license to operate. There are also reports of fishing boats converted for passenger operations, increasing the risk to these passengers if the proper vessel modifications are not made.

Search and rescue capabilities should be upgraded and improved, requiring a considerable investment in rescue boats, communication equipment, support facilities and rescuer training.

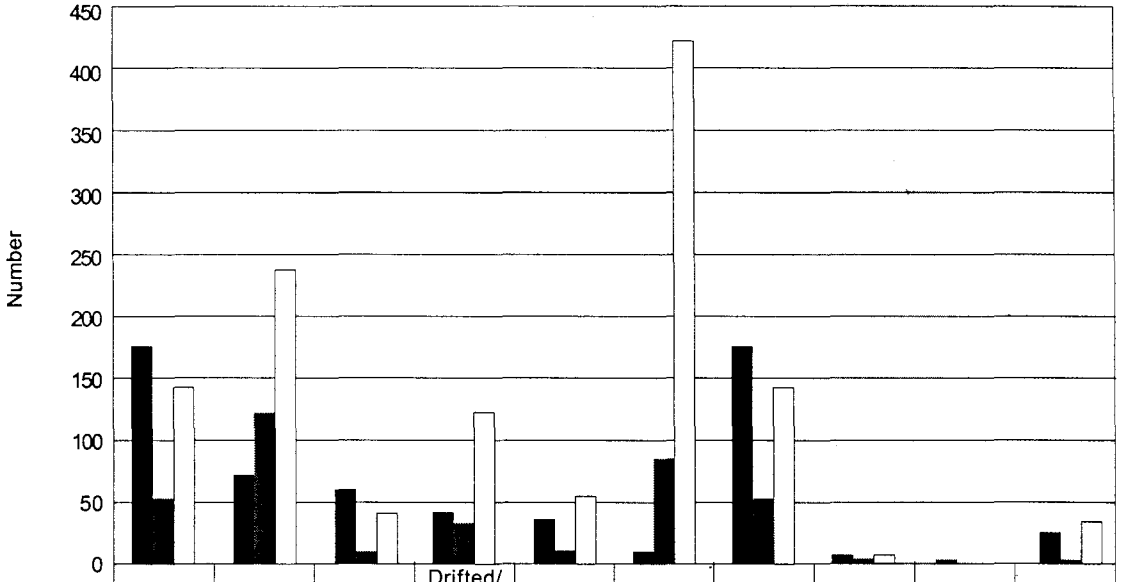
During the last 5 years, a remarkable growth in the routes serviced by fast ferry craft, particularly in the Visayas, has been observed. These fast ferries have cut travel time by almost half in most of the routes, improving passenger movement between the shorter passenger routes. Further expansion of fast craft service is seen, particularly in the areas served by traditional wooden hulled ferryboats. The route optimization of such fast craft is interesting because there may be some ports which can more practically be served by these craft than by planes or the slower large passenger ferries. Fast craft may also offer an alternative to the more usual passenger ferry and land transport options even for the longer haul voyages and coastal travel along the Western coast of Luzon or the Eastern coast of Mindanao.

However, the potential for disaster of the fast craft is obvious, given the shorter response time coupled with the greater magnitude of force in case of collision. Hence, navigation hazards along the routes must be well documented for fast craft operations, other craft plying the route should be aware of fast craft operations and traffic systems near crowded ports must be established. The crew must also exercise extra care during the course of the voyage at all times.

SMALL CRAFTS

Small indigenous fishing craft are ubiquitous features of the country's fishing communities, dotting nearly all beach areas and serving as a major fishing and transportation platform for these communities. These boats are mainly of the *banca* type, which can be either non-motorized or motorized. Their sizes vary from 3 to 20 meters in length for the former and up to 30 meters for the latter. A count in 1985 found more than 465,000 *bancas* across the regions. The lack of more recent statistical data for small crafts points to a major research gap which must be addressed for development and planning purposes.

Small craft are over-represented in the total count of accidents at sea, a finding which can be accounted for in the total percentage of such sea going crafts, their construction, including materials used, as well as lack of safe harbors and/or berthing places for them. *(Figure 4)*



	Aground	Sank	Caught Fire	Drifted/ Engine Trouble	Collision	Capsized	Rammed	Missing	Flooding	Others
■ M Vessels	176	76	66	45	40	14	9	4	3	20
■ F Vessels	55	124	11	35	12	83	4	26		3
□ M Bancas/Others	143	238	45	130	56	424	5	89		36

Figure 4.
Classification of incidents from 1990 to 1999 (M Vessels refer to passenger ships, F Ships are fishing vessels and M Bancas are the small motorized bancas.)

The double outrigger nature of Philippine small crafts makes vessel seaworthiness dependent on the strength of the outrigger beams connecting the outrigger to the main hull. Outrigger floats are mainly of bamboo and serve to increase the initial stability of the banca. They stabilize the craft by minimizing the rolling motion induced by the waves, providing comfort to the passengers - a major reason for the ubiquity of the *banca* form. Such stability however, is very much dependent on the outriggers; too heavy or overloaded boats may cause the beams to break and thus, to capsize the boat.

There is no standards, rules or guidelines for small boat construction. While a majority of these craft have more than adequate strength in their beams, the strong bending movement induced by high waves expose the wooden or bamboo beams of boats larger than 10 meters to very severe stresses, weakening the material so that there is the danger of sinking or capsizing. Losing one or both outriggers can immediately swamp the main hull with water, rapidly filling up the interior.

A danger during high waves is when excessive rolling motions prevent the hull from returning to an upright position, flipping it over. This may happen when the center of gravity of the boat is too high and the outrigger floats are neither large enough nor have sufficient buoyancy. The application of external moment may exceed the righting force so that the vessel flips over or sinks when the hull fills with water and the materials of the craft lack sufficient buoyancy to enable the hull to float. This is another standard to consider, particularly with large topheavy boats and small outrigger floats.

Any consideration of design for resistance and propulsion efficiency will find the *bancas* already highly optimized with the present hull evolving through a long period of trial and error. However, boat builders usually scale up their designs to accommodate larger fishing gears and bigger, more powerful engines using the same design as the smaller ones. Such scaling up results in larger forces acting on critical areas of the beams, requiring the use of very strong materials of sufficient dimensions to withstand the stresses present.

It therefore becomes necessary to institute standards defining material type, strength characteristics and minimum dimensions, particularly for the beams. Bamboo has sufficient strength for small enough craft, particularly if doubled or rein-

forced with wooden beams. But in larger boats whose beams are made of wood, the structure must be of sufficiently high quality, durability and dimensions – all of which must be specified in an administrative issuance for strict compliance. Additional reinforcements such as steel rods or altogether replacing the booms with steel or fiber reinforced material should be considered.

Construction for the main hull is usually of a semi-dugout nature where the bottom component is a carved log to which side frames are attached and plywood nailed to the frames to form the sides. This form evolved from dugout logs which were found to be virtually unsinkable, however, the use of plywood and adding cargo space result in less buoyancy when water enters the hull. Standards for frame size, plywood thickness as well as material qualities have to be determined and enforced to ensure more reliable operation in varying sea conditions.

Power must also be sufficient to enable small craft to more quickly reach safety in times of danger. Most engines have more than enough power for the size of the craft with a large number using second hand truck diesel engines converted for use in the marine environment. Second hand engines may be sufficient in calm waters and under safe conditions, but the need for reliability and performance when confronted with larger waves demands that rules be devised setting standards for engine make, service age, maintenance record and minimum horsepower. It may also be necessary to make engine reliability inspections mandatory, focusing on the maintenance record; the absence of such leaves passenger safety to the shipowner's discretion or to crew competence in undertaking engine repairs when needed.

Life saving paraphernalia for larger vessels are standard, although the same cannot be said for the smaller craft. Most small craft remain afloat even when capsized because of the highly buoyant nature of the semi-dugout *bancas*. But overloaded or weighed down small to medium crafts where the dugout component of the hull cannot provide sufficient buoyancy may capsize and sink when water enters the interior.

Suggestions have been made to replace the *banca's* outrigger hulls with Western style single hull non-outrigger forms. Many efforts have also introduced monohulled forms. But most monohulls introduced as alternatives are of fiberglass reinforced plastic (FRP) 10 times more than the native *banca*. There are also many

instances when outrigger boats begin as single hulled boats but eventually add outriggers to increase initial stability and to take in more cargo or to increase loading capacity. For certain larger size crafts then, it may only be when the scarcity of wood makes the dugout very expensive that the monohull type made from FRP or steel will gradually replace the existing fleet.

SAFE HARBORS AND ANCHORAGES

It is normal to see beaches full of outrigger boats in most coastal communities throughout the year, especially during the fishing season. However, it is rare to see fully protected harbors where small crafts can shelter during bad weather except for the well-established ports mostly located in large cities.

While the size of most craft allow beaching during typhoons, a safe harbor or protected anchorage is a necessity for those sizes that cannot be manhandled. Larger boats typically stay at anchorage near fishing grounds for the duration of the season. The absence of such protection results in the transfer of fishing activities to the leeward or protected side of any island where they operate. For instance, ring netters and purse seiners operate in the northern parts of islands when southwest monsoons occur and move to the southern parts when the northwest monsoon blows. Such a practice is advantageous from the viewpoint of fisheries management as it allows for the replenishment of stocks. However, safe harbors with adequate sea wall protection, berths or protected anchorage can prevent damage during typhoons as what happened in 1998 with Norming when 82 small boats capsized off Panay Island including Caticlan (near Boracay). Natural safe harbors exist and are in fact used by boats during typhoons but these are mainly undeveloped and devoid of any infrastructure or port facilities.

Ideally, fishing communities with a significant fishing fleet should have a safe and well-protected harbor. Protective structures include a breakwater or seawall capable of keeping out destructive waves and strong winds, anchorage of sufficient depth, berths to tie boats to and slipways for hauling or launching boats. For now, such facilities are present only in river mouths, enclosed bays and in developed and well established ports. Boats basically have to fend for themselves and seek protec-

tion wherever possible in other areas. While several attempts have been started to establish municipal ports, the results are inadequate, with most efforts ending in a single jetty or pier, mainly for the purpose of landing caught fish.

Most fishing grounds are located near the coast but an increasing population and finite resources have led to the overexploitation and depletion of traditional fishing grounds. Fishing activities are now conducted further from shore, requiring bigger and more capable boats. It thus becomes necessary to plan for fully protected harbors for fishing fleets in selected fishing areas.

Natural safe harbors exist... but these are mainly undeveloped and devoid of any infrastructure or port facilities

An underdeveloped sector of the marine industry has to do with small craft for pleasure and sports fishing. Most of these vessels cannot be beached, requiring berthing or anchorage. The more expensive value of these vessels also requires that they be amply protected from rough weather. Some resorts have already built marinas for yachts, along with breakwaters or shelters, but their use is limited to the more upscale and expensive boats.

In better times with more improved finances, perhaps more people will be able to afford the pleasures of the sea coupled with the sustainable utilization of marine resources. Engineering interventions can then be prioritized to protect more costly investments in crafts and marine structures.

NAVIGATIONAL HAZARDS

A major characteristic of Philippine seas is the presence of *payaos* or anchored rafts serving as platforms for fish aggregating devices. Usually anchored at depths from 200 to as deep as 3500 meters, they sometimes straddle the sea-lanes. Found throughout the archipelago and employed by the fishing industry to ensure a good catch, their popularity is such that they have been adopted by other countries all over the world. There is no policy at present on the deployment of *payaos*; incidents have been reported of propellers snagging on the ropes and of aggregating devices

attached to the rafts. They thus present a navigational hazard for smaller sized vessels traveling at night without a radar. Some rafts are sturdier and made of steel with cables in the upper portion of the mooring system; such a construction is a source of danger and damage in cases of collision with moving vessels.

Lighthouses are crucial to navigation, particularly at night, so that lighthouses are being installed or upgraded throughout the country, often with the aid of foreign funding. Particular attention has been given to the better traveled routes such as that from Manila to Cebu, with lighthouses installed in most of the waypoints and critical landmarks. Hence, this aspect of safety at sea has been adequately addressed. However, lighted buoys marking the more dangerous shoals and underwater obstructions are needed, particularly near well-traveled routes.

SHIPBUILDING AND SHIPREPAIR INDUSTRIES

The Philippines does not have a competitive shipbuilding industry. Very few shipyards regularly construct new ships, with most doing mainly repair work. There is therefore room for growth and expansion in the ship repair business, considering the number of ships constantly in need of repair in the local market. Most shipowners prefer to purchase second hand ships because of their faster capital return, with ships larger than 500GT mostly sourced abroad. Only the Tsuneishi Corporation in Balamban, Cebu produces regularly for the foreign market.

The government considers shipbuilding a major investment priority, offering tax breaks and other incentives to investors. So far, the only significant investment in this area has been the Keppel and the Tsuneishi shipyards, both of which are foreign owned. Lack of reliable steel supplies, the absence of ancillary industries and an unfavorable local market are major reasons why this industry cannot seem to take off.

Even the boatbuilding industry has essentially remained a backyard undertaking with the construction of the ubiquitous *bancas*. Some progress has been shown in the production of fiberglass boats although the high costs involved have limited production to government contracts or to the leisure type boats which only the more affluent can afford.

The availability of naval architects to do the necessary calculations for stability also impacts on safety. Without a significant shipbuilding industry, naval architecture as a field of study attracts very few students, with a graduation average of 12 to 15 a year for the past 10 years (data taken from NAMEI). The absence of implementation of classification society rules and regulations has an impact on the final design for smaller craft, which are now mainly left up to the boatbuilder. Construction typically comes before the line drawing, particularly for small to medium passenger and cargo craft as well as for fishing boats in the medium to small categories (150 to 20.1 and 20 to 3 gross tons). The hydrostatic calculations necessary for stability are normally dispensed with, or if done at all, are based on as-built plans. Most construction is done by boatbuilders whose skill is based on experience handed down through generations of such workers.

The more crucial crafts are those purchased second hand and modified for another purpose as well as those newly built from a copied design. This is where accurate calculations are needed to ensure stable and safe platforms. Of particular importance are the larger type crafts which originally begun as fishing boats but were converted into passenger vessels after substantial modifications. Stability standards to structural specifications must be strictly enforced to ensure proper performance and safety.

Shipbreaking is another potential growth area, albeit an environmentally unfriendly one, because of the many pollutants and other toxic substances with potentially disastrous effects which ships carry. This was found to be the case in India where as much as 80 percent of the world's old fleet is disposed.

MARINE ENVIRONMENTAL SAFETY

As a player in the Asian region, the Philippines straddles and lies adjacent to the crucial sea-lanes that oil tankers traverse to bring precious oil to Taiwan, Japan and Korea. This is the South China Sea to which a lot of attention has been paid because of its strategic and natural resource value. With a proclaimed 200 kilometer Exclusive Economic Zone encompassing 220,000,000 hectares, the Philippines has a significant position in the area and is a permanent component in the dynamics of utilization and management of this resource.

More than half of the world's annual merchant fleet tonnage passes through the Straits of Malacca, Sunda and Londok in Indonesia, with most ships continuing on to the South China Sea. All ships passing through the Malacca and Sunda straits pass near the Spratly Islands, a group of islands in the middle of the South China Sea contested by China, Malaysia, Vietnam and the Philippines. Ships that pass through this region carry mainly raw materials such as crude oil and liquefied natural gas. More than 80 percent of the crude oil supplies for Japan, South Korea and Taiwan flow through the South China Sea from oil suppliers in the Middle East, Africa and other nations. This translates to 75 percent of South Korea's energy supply and 60 percent of the supply for Japan and Taiwan.

The Philippines is blessed with a very diverse aquatic environment... hence, the country's food supply and biodiversity will be at risk in cases of disaster.

Supertankers with up to 100,000-ton capacities pass near the islands, increasing the potential for environmental disaster. Even within the archipelago, tankers carrying fuel to the different islands are potential sources of oil pollution, should collisions or leakage occur. While regular oil discharges are covered by existing rules and regulations, we do not have the capability to cope with large-scale oil slicks and massive discharges. The Coast Guard is mandated to take care of pollution but capability and equipment buildup is needed to ensure preparedness and the ability to contain or mitigate oil pollution whenever it occurs. The Philippines is blessed with a very diverse aquatic environment, including coral reefs, mangrove swamps and seagrass beds, hence, the country's food supply and biodiversity will be at risk, in cases of disaster.

GOVERNMENT INSTITUTIONS

Many institutions are involved with our maritime sector such as the Maritime Industry Authority (MARINA) for vessels, shipbuilders and crew licensing; the Philippine Coast Guard (PCG) for search and rescue; the Philippine Ports Author-

ity (PPA) for our ports, the Bureau of Fisheries and Aquatic Resources (BFAR) for fishing ports and fishing vessels; the Philippine Regulatory Commission (PRC) for licensing; the Philippine National Police-Maritime Command for law enforcement; the Philippine Navy for search and rescue and patrols; the Department of Interior and Local Government (DILG) for the Local Government Units; the National Mapping and Resource Information Authority (NAMRIA) for navigational charts; the Department of Labor and Employment (DOLE) for workers on board vessels; the Maritime Training Council (MTC), the Technical Education and Skills Development Authority (TESDA) and the Commission on Higher Education (CHED) for crew training and education. There have been arguments for and against the creation of a Department of Maritime Affairs to consolidate all the functions which are now assigned to various departments. A major argument against this would be the additional financial costs a new department and office would entail; an argument for it is the establishment of a more focused and well-coordinated bureaucracy which does away with the need for inter-department coordination and all the difficulties this entails. But whether a new office is created or the present set-up of various offices maintained, the need to attend to our marine environment is of primary importance.

The Philippine Marine transportation industry is an important sector because of our country's geographical nature. Safety is of primary importance, given the country's record of maritime tragedies and incidents. A lot of work needs to be done, not only ensure safety on the seas, but also to develop the potential of our seas. In the short term, developing appropriate policies, rules and regulations and the proper enforcement of such rules may decrease the number of accidents at sea. For the medium term, research and development must play a crucial role in providing the requisite information needed to create or adjust policy to make the industry viable and to assure safe travel. In the long term, education is the best and only way to ensure the institution not only of maritime safety consciousness but also of an appreciation of our marine environment and the desire to fully develop this sector.

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