Analysis of shipping patterns in the Mediterranean and Black seas

Jean-Pierre Dobler

Senior Partner/Manager of ECOMAR, Boissy le sec, France

Face to the current absence, incompleteness and/or inaccessibility of published statistical information on the multifarious shipments loaded and unloaded in the more than 150 commercial ports of the Mediterranean/Black seas region and on the corresponding shipping routes origin and destination matrices, this paper mostly focuses on the ship movements originating from the rest of the world that are directed towards the Mediterranean Basin. When marine bio-invasions in the region are considered as shipping-related, it means that they have been triggered by such movements. However, intra-Mediterranean/Black seas ship's movements are also an important vector for the further regional dissemination of invading species. Finally, the considered geographical area may also be a source for marine bio-invasion, as the maritime transport "corridors" linking the Mediterranean sea with the rest of the oceanic sphere work both ways.

PART PLAYED BY THE REGION ON THE GLOBAL SEA-BORNE TRADE STAGE

The last available set of global detailed origin/destination matrices of the main cargo categories dates from the year 1985 and was based on a Pilot study undertaken by the UNO Statistical Office. Since this time, the lack of funds – and also, alas, lack of interest of member-states for maritime activities – has prevented the UNO Statistical Office to update such matrices. The 1985 Mediterranean region data are presented in Table 1.

Obviously, the volumes of cargoes loaded and unloaded in, or transiting by, the Mediterranean Basin are different today than in 1985. Nowadays according to the last available estimate in 2001, world sea-borne trade reaches 5,500 millions tons, a value which is 77% higher than the corresponding 1985 figure shown in Table 1. However, the structure of the global maritime transport – i.e. its distribution by cargo categories and world major economic areas – is rather rigid, even over a long period such as 1985-2001. Therefore, the following comments based on Table 1 will give a rough preliminary estimate of the part played today by Mediterranean countries in the world sea-borne trade.

1) In 1985 the Mediterranean ports overall cargo trade represented 21.1%, and transiting cargoes 9.9%, of the world total. Thus, the part played by the Mediterranean Sea in the global maritime transport shipments can be estimated at the time to about 30%.

2) The geographical distribution of the total Mediterranean 1985 sea-borne trade was as follows: 26.5% was inter-Mediterranean, a nearly equal share of 27.1% corresponded to cargoes loaded in Mediterranean ports for non-Mediterranean destinations. The balance of 46.4%, not far from half of the total, corresponded to shipments originating from the rest of the world and unloaded in Mediterranean ports. Of course, it is the latter that interest us

Table 1 . Distribution by major cargo categories and main origin/destination of the Mediterranean sea-borne trade in 1985 (figures in millions tonnes).

	Mediterranean ports sea-borne trade				World sea-borne trade		Mediterranean Transit sea-borne trade		
	With the rest of the World						from/to	W. of Gibraltar	
Main cargo categories	Inter Med.	from Med.	to Med.	Total	% Med.	Total	Black Sea	E. of Suez	Total
Crude oil	102.51	62.40	98.41	263.37	28	972,22	9,05	12.00	21,05
Oil refined products	20,16	27.61	37.40	82.17	24	341.87	4.68	16.55	21.23
Liquefied gas (LNG/LPG)	6.17	4.77	3.19	14.03	23	39.89	-	0.42	0.42
Liquid chemicals	4.00	5.15	6.27	15.42	19	82.76	1.74	10.10	11.84
Sub-total liquid bulk cargoes	*132.74*	*99.98*	*142.27*	*374.99*	*26*	*1,473.74*	*15.47*	*39.07*	*54,54*
Iron ore	0.55	1.91	25.92	28.38	9	315.50	0.02	7,66	7.68
Coal	0.04	0.06	41.36	41.46	15	285.17	2,11	27.70	29.81
Grains	1.97	2.38	23.14	27.49	15	188.34	20.26	11.99	32.25
Other dry bulk cargoes	27.43	47.28	51.07	125.78	20	629.27	8.56	49.02	57.58
Sub-total dry bulk cargoes	*29.99*	*51.63*	*141.49*	*233.11*	*16*	*1,418.28*	*30.95*	*96.37*	*127. 32*
Refrigerated goods	0.79	3.92	2.56	7.27	23	32.06	0.10	3.11	3.21
Containairisable cargoes	4.80	16.04	6.95	27.76	22	128.61	0.63	14.68	15.31
Other general cargoes	3.81	5.54	11.38	20.73	16	139.49	0.62	14.37	14.99
Sub-total general cargoes	*9.49*	*25.50*	*20.89*	*55.79*	*19*	*300.16*	*1.35*	*32.16*	*33.51*
TOTAL all cargo categories	**172.13**	**177.11**	**304.65**	**653.65**	**21**	**3,104.18**	**47.77**	**167.60**	**215.37**

primarily here, as the carrying ships will have loaded their ballast water and gathered their most recent hull-fouling species outside the basin. It can be remarked in this context that the ships in transit (not having to load or unload cargo in the Mediterranean ports) do not normally discharge ballast water when crossing the Basin. However, they can carry and release some unwanted species in the fouling attached to their submerged hull and appendices, specially chains and anchors or living in other on-board water reserves and pipes.

3) Analysing cargoes movements does not cover the whole of our problem. Ships entering the Basin in ballast condition to load cargoes in its ports and terminals are among the most likely candidates for the dissemination of alien species. If we consider the general cargo trade, we find that about 20% of the required transport capacity for Mediterranean “exports” is not compensated by that for “imports”, which means that many of the corresponding vessels have entered the area fully or partially ballasted with sea-water loaded west of Gibraltar or east of Suez.

4) For liquid and dry bulk cargoes, the two other major aggregated categories, “imports” exceed “exports”. However, due to the unit size and technical specific requirements of their respective cargoes, quite an important number of oil, chemical and gas tankers loaded in Mediterranean terminals with shipments intended for the rest of the world may previously have entered the basin with their ballast tanks fully loaded with exogenous water, and, therefore, are possible important vectors of alien species.

5) Under the aegis of EUROSTAT and of its regional “offspring” MEDSTAT, a research effort is currently considered to provide and assemble detailed origin and destination matrix of the Mediterranean sea-borne trade on the base of national ports statistics. This effort should be undertaken with the requirements of scientists and officials in charge of monitoring, controlling and fighting the various shipping-related and port activities-generated marine pollution sources in mind. The importance of having suitable statistical data on ships movements and shipped cargo trade was particularly stressed by the author in the Maritime Transport survey prepared for the “Transboundary Diagnostic Analysis” of the Mediterranean marine pollution sources, edited by the UNEP/MAP coordinating Unit (1997). Therefore, it is hoped that the scientific community will be, in a not too distant future, in a position to dispose for the Mediterranean region of more recent sea-borne trade origin/destination matrices than the ones just presented. A similar effort should be undertaken for the Black, Marmara and Azov seas by the concerned coastal countries.

SHIPPING MOVEMENTS TOWARDS THE MEDITERRANEAN/BLACK SEAS AREA

In fact, precise data about global shipping movements are already available, but outside of the public domain, being gathered and assembled by a private company from which they can be extracted for a fee, often costly. Most of the users of these data banks belong to the commercial sector: shipping companies, shippers and maritime consultants; they generally require specific data about a ship type and/or a given area for marketing studies. Conversely, the marine scientific community don't seem to have much utilised this source of information.

In preparation of this Workshop, the author approached a colleague, member of the International Maritime Statistics Forum, who is a manager at Lloyd's Maritime Intelligence Unit (LMIU), a London maritime consultancy firm, part of the INFORMA Group which is the publisher of the shipping daily Lloyd's List. The request, that was very kindly granted, was to obtain an extract of their global ship movements data bank in order to sort out the 2001 sailings towards the Mediterranean and Black seas from the rest of the world, and analyse these movements by areas of origin and types of vessel.

The resulting spreadsheet is too cumbersome to be presented here, as it comprises 22 origin areas in columns and 83 Vessel Types in lines. Therefore Table 2 was aggregated to present only nine larger areas and 15 types of ship. The larger origin geographical areas presented are as follows:

- in Table 2-a, one finds west of Gibraltar:
  - North-East Atlantic, combining *Iberian Atlantic, North Africa, North Continental Europe* and *UK/Eire*;
  - North West Atlantic, combining *Canada Great Lakes* and *US Atlantic*;
  - Centre East Atlantic (*West Africa*);
  - Centre West Atlantic, combining *USA Gulf, Caribbean* and *Central America*;
  - South West Atlantic (*South America Atlantic*);
  - South Pacific, combining *South America Pacific* and *Australasia*;
  - North East Pacific (*North America Pacific*).
- in Table 2-b, one finds east of Suez:
  - Red Sea and Indian Ocean, combining *Red Sea, Arabian Gulf, Indian subcontinent and South* and *East Africa*;
  - North West Pacific and China Sea, combining *Far East Asean, Far East China Sea* and *Japan*.

The original LMIU areas that have been aggregated or re-named are printed in italics. There is a peculiarity about *North Africa*: according the LMIU geographical distribution of origins and destinations, ships movements originating from this area towards Mediterranean and Black seas ports include not only those from Moroccan Atlantic ports entering through the Strait of Gibraltar but also from the Egyptian Red Sea ports passing by the Suez Canal. Of course the marine biological particulars of these two zones are very different and it would be advisable if an in-deep study of bio-invasion corridors is undertaken in the future to sort out the corresponding ship movements originating from these two opposite directions.

Other geographical ambiguities arise from the spherical shape of the Earth: ships sailing from the west part of the South Pacific area (i.e. east of Australasia) usually reach the Mediterranean and Black seas by the Suez Canal rather than through the Panama Canal, and then the strait of Gibraltar. The large container vessels employed in "Round of the World" services and calling in Mediterranean ports may came from the US west coast either by Panama or by Suez. However very few of them, if any, do not call at intermediate ports when sailing along the east-west route. Therefore, they are not listed as coming from the North-East Pacific.

For the geographical areas aggregation process required to prepare Table 2, I have tentatively combined waters not too much different in their oceanographic particulars. But, as I am not a marine biologist, I am well aware that these various combinations are open to criticism. For instance, to have placed China Sea and North West Pacific in the same group may seem surprising; but, in fact, there are only 123 ship movements registered from Japan, less than 5% of the

total of this wide area. In order to retain the wealth of detailed information provided by LMIU as regards the 22 areas of origin of the vessels calling at the Mediterranean/Black seas ports, Chart 1 provides the whole geographical distribution of sailings in percentage and Chart 2 presents, for each area, a ship type distribution by tanker, bulkcarrier, other cargo carrying vessels (bulk cargo ships and general cargo ships) and other ships.

As regards ship types, Table 2 allows a more detailed analysis: most of the listed merchant vessels are singled out in the LMIU spreadsheet. However in our table Chemical Tanker also includes Chemical oil tanker; Bulkcarrier also includes Ore, Ore/oil, Bulk/oil and Bulk/container carriers; Container vessel also includes Container reefer; Multipurpose cargo vessel aggregates General Cargo and Part c.c. (Container carrier). The entry "Non specific tanker" means that the information gathered by LMIU does not allow to determine if the considered vessel is carrying crude oil or refined petroleum products.

Table 2-a. Shipping movements towards Mediterranean/Black seas area from the rest of the world - from West of Gibraltar.

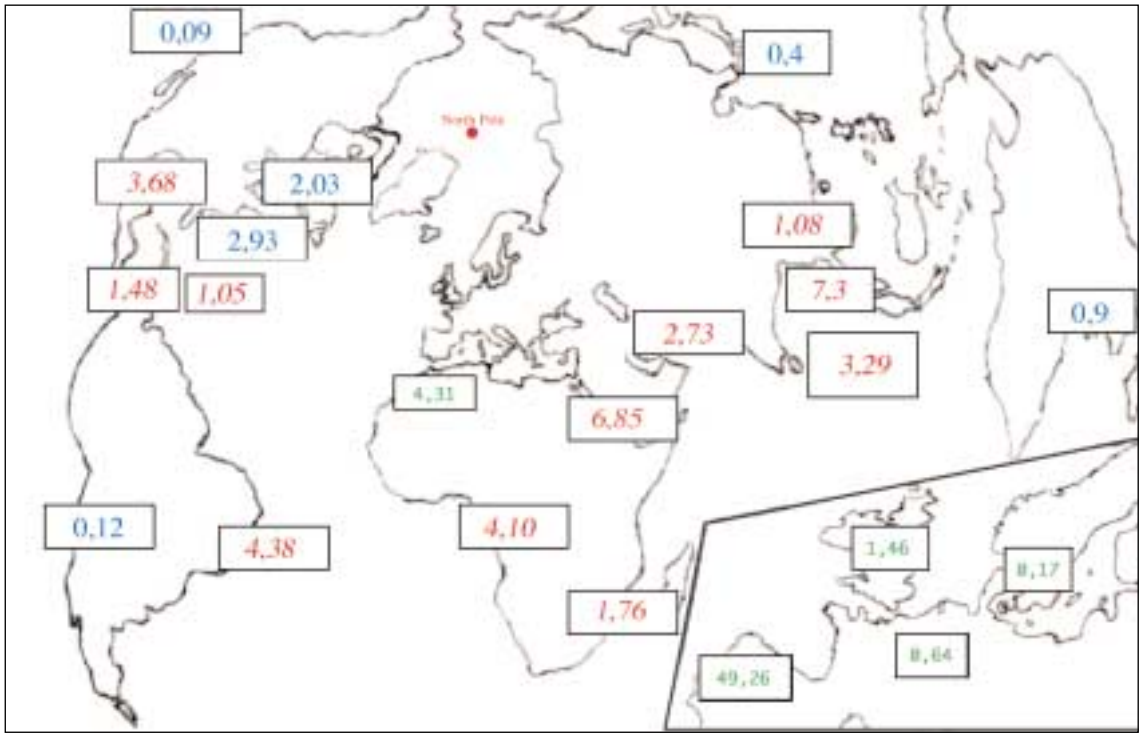
Areas of origin	**N-E Atl.**	**N-W Atl.**	**Ct-E Atl.**	**Ct-W Atl.**	**S-W Atl.**	**South Pac.**	**N-E Pac.**	**Total West of Gibraltar**
Types of ship								
Crude oil tanker	442	62	168	231	52	2	3	960
Non specific tanker	36	4	5	2	2	0	2	51
Oil product tanker	695	112	105	57	39	2	0	1010
Gas (Lng-Lpg) tanker	999	17	39	155	19	1	0	1230
Chemical tanker	1730	89	55	92	40	13	1	2020
Edible liquid tanker	30	0	2	0	0	0	0	32
Bulkcarrier	2122	427	220	762	734	273	14	4552
Sub-total bulk cargo ships	*6054*	*711*	*594*	*1299*	*886*	*291*	*20*	*9855*
Container vessel	3008	553	270	161	203	1	0	4196
Ro/ro cargo vessel	774	58	88	8	19	0	0	947
Multipurpose cargo vessel	6392	126	151	121	99	12	4	6905
Refrigerated vessel	709	10	124	224	69	4	2	1142
Heavy-lift semi-sub vessel	15	15	2	12	0	0	0	44
Barge carrier	21	2	1	12	0	1	0	37
Vehicule carrier	572	31	10	0	6	1	0	620
Sb-total general cargo ships	*11491*	*795*	*646*	*538*	*396*	*19*	*6*	*13891*
Passenger vessels	221	0	2	0	14	0	0	237
Total transport vessels	***17766***	***1506***	***1242***	***1937***	***1296***	***310***	***26***	***23983***
Other ships	3002	17	16	68	48	3	1	3155
Grand total	**20768**	**1523**	**1258**	**1905**	**1344**	**313**	**27**	**27138**

Table 2-b. Shipping movements towards Mediterranean/Black seas area from East of Suez and totalisation of movements outside the area.

Areas of origin	**Red Sea Indian Ocean**	**NW Pacific China Sea**	**Total East of Suez**	**Total West of Gibraltar**	**All origin movements Numbers**	**% per types**
Types of ship						
Crude oil tanker	193	14	207	960	1167	3,54
non specific tanker	42	8	50	51	101	0,31
Oil product tanker	187	74	261	1010	1271	3,85
Gas (Lng-Lpg) tanker	173	43	216	1230	1446	4,38
Chemical tanker	147	74	221	2020	2241	6,79
Edible liquid tanker	1	0	1	32	33	0,1
Bulkcarrier	632	622	1254	4552	5806	17,56
Sub-total bulk cargo ships	*1375*	*835*	*2210*	*9855*	*12065*	*36,55*
Container vessel	1012	1225	2237	4196	6433	19,49
Ro/ro cargo vessel	112	16	128	947	1075	3,26
Multipurpose cargo vessel	542	146	688	6905	7593	23
Refrigerated vessel	96	20	116	1142	1258	3,81
Heavy-lift semi-sub vessel	6	4	10	44	54	0,16
Barge carrier	2	12	14	37	51	0,15
Vehicule carrier	97	299	396	620	1016	3,08
Sub-total general cargo ships	*1867*	*1722*	*3193*	*13891*	*17184*	*52,06*
Passenger vessels	35	3	38	237	275	0,83
Total transport vessels	***3180***	***2261***	***5441***	***23983***	***29524***	***89,44***
Other ships	293	136	429	3155	3584	10,56
Grand total	**3473**	**2397**	**5870**	**27138**	**33008**	**100**

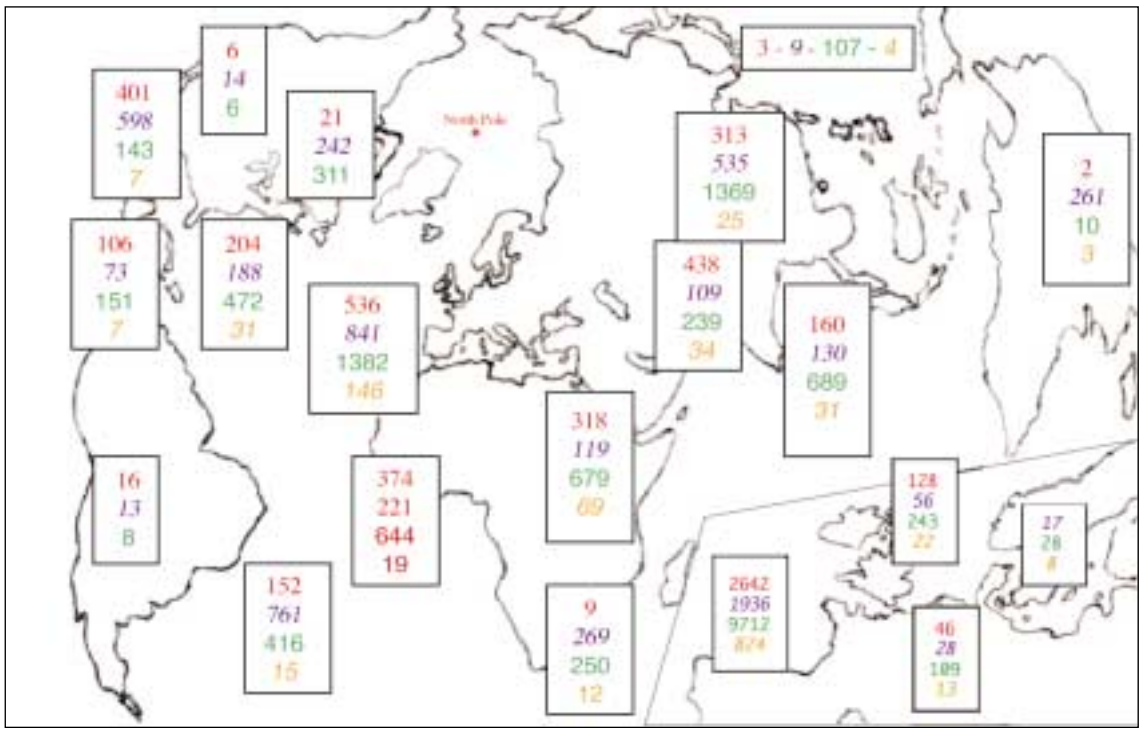
Source : LMIU processed by ECOMAR

Chart 1. Total ship movements towards Mediterranean/Black seas region distributed in % by main origin area.



Ships have their last port of call in :
- N-O European and North African waters for 55,84%
- distant temperate waters for 6,47%
- sub-tropical and tropical waters for 37,69%

Chart 2. Numbers of ship movements towards Mediterranean and Black seas area by region of origin in 2001 registered by Lloyd's Maritime Intelligence Unit (LMIU).



Ship types colour code : tankers; bulkcarriers; other cargo carrying vessels; other ships

Altogether, ships of the above mentioned types and some other form in the table a sub-group called “Transport vessels”, comprising all cargo and/or passengers (including car ferries) carrying ships. The “Other ships” sub-group gathers all the types of fishing, service and harbour craft. It should be emphasised that Oil drilling platforms (floating or semi-submersible) are not considered as ships and that their movements towards the Mediterranean/Black seas area from other regions have not been taken into consideration. The same is obviously true for Warships.

What can we learn from Table 2 and from Charts 1 and 2 concerning the origin of the current shipping patterns linking the outside marine world with the Mediterranean/Black seas area ?

1) The concerned ship movements are numerous as they exceed 30,000 for the last year. Of course, in most of the cases the same ship is counted twice or several times, but for our purpose it is the number of actual voyages and not of individual vessels concerned which has to be considered.

2) The sailings of sea/river units towards Black Sea from the Baltic by the Russian inland waterways have not been recorded. The same is true for sailings from the North Sea via the Rhine-Danube Canal. In any case, the Danube was still obstructed in 2001 by the remains of the Novisar bridges destroyed during the Bosnian war.

3) Nearly 80% of these movements came from the West of the Strait of Gibraltar and among them about three-quarter originated in the North-East Atlantic area where the waters already mix naturally with the western Mediterranean ones.

4) More distant sources in western areas are mostly found in tropical zones for 12.7% of movements, when for temperate zones (round North America) the percentage of origins is only 6.3%.

5) Concerning East of Suez origins, after deduction from the total movements of the 123 voyages started in Japan, we can conclude that about 98% of this total have been initiated in tropical waters.

6) When considering the overall picture of the year 2001, it must be emphasized that the voyages initiated in tropical waters represent about a third of the ship movements towards the Mediterranean/Black seas area. This has a particular significance for our subject matter when considering the present warming trend of Mediterranean surface waters.

7) Finally, I will remark that the multifarious movements of ships just transiting through the area from the Strait of Gibraltar to the Suez Canal or in the reverse way, without calling at any port of the region, could not be accounted for in extracting LMIU data due to the structure of their bank. Normally, as previously remarked, a ship in transit does not have to adjust operationally its ballast water volume; however, some accidental releases are likely to happen from time to time. If, in the future, some transiting vessels opt for the “continuous ballast water exchange in open-sea system” recommended in the IMO “Guidelines for ballast-water management”, the possible effect of these small but repeated releases from each ship during the Mediterranean Sea crossing should be monitored and, eventually, prohibited, keeping in mind the semi-closed characteristic of this basin.

DISTRIBUTION OF SHIP MOVEMENTS TOWARDS MEDITERRANEAN/BLACK SEAS AREA BY PORT OF DEPARTURE AND ARRIVAL

The ship movements data kindly supplied to the author by LMIU were nor detailed by ports of departure and arrival but only by geographical areas of origin, being understood that they all had the Mediterranean or Black seas for destination. In fact what was taken into consideration was the last port of call outside the area of destination. Therefore no information is available on the port of origin of the voyage, which is often located in another geographical area than the last port of call.

This lack of detailed information concerning the successive ports called at by a vessel during a given voyage is particularly regrettable for ships plying along regular routes which nowadays are principally container and Ro-ro vessels, according to the schedule of cargo lines and consortia. In fact LMIU will provide such information about the ship movements into a given area for any reference period but for a cost which may reach thousands of sterling £ depending on the size of the extraction requested. It is possible, however, to find detailed information about port of departure and/or arrival on the Internet site <http://www.shipguide.com/cgi/esc>, the data bank

of which registers the name and operator of the ships engaged into regular services having called, or intending to call, at a given port of the world during a short period of a few weeks or a month. This site offers the great advantage to be access free. Table 3 has been prepared on the basis of data gathered from this bank for arrivals in the main Mediterranean and Black seas ports during the period September-October 2002.

Table 3. Mediterranean directed cargo liner services analysis by port of origin and destination in September/October 2002, according call data collected on Internet.

Destination \ Origin	Bremenhaven	Rotterdam	Antwerp	Felixstove	LeHavre	Montreal	Boston	New-York	Baltimore, Norfolk	Charleston	Savannah	Houston	Ponce	SanJuan	Tampico/Veracruz	Cartagena	Pto.Cabello/LaGuaira	Salvador/Suape/Belem	Dakar/LasPalmas	Abidjan	CapeTown/LaRéunion	Jeddah	Dubai	Karachi	Mumbai/NhavaSheva	Colombo	LaemChab,	PortKelang	Singapore/TanjungPelapas	Hong-Kong/Shangai	Busan	Yokohama	Fremantle	Melbourne	Seatle	Oakland	LA/LongBeach	Total calls	Destination
West Med																																							*WestMed*
Algesiras	3	1		1				1		2											4																	12	Algesiras
Cartagena				2																																		2	Cartagena
Alicante								1																														1	Alicante
Valencia								2	1		4				1							1																9	Valencia
Barcelona							1	3	1	3	1			2	1		1	4			8				3	3		3	3		1	2	1			3	3	47	Barcelona
Marseilles-Fos				2		1		2		2	2							2	3		6	3				4	1	8	2				1			1		40	Marseilles-Fos
Genoa				1		1		1	1	6	2			3	2	2	2	3	3		1	3						6	3							3	2	45	Genoa
LaSpezia											4															1		1						1				7	LaSpezia
Naples						2	3	1		6								1		1	5		4	2	3	3		9	4							4		48	Naples
Salerno																		1																				1	Salerno
GioaTauro	1					1				2	5	4		1								3			3	2		8	6	3	4	1						44	GioaTauro
Tunis								2																														2	Tunis
Algiers								1																														1	Algiers
Mostaganem									1						1																							2	Mostaganem
Adriatic/East Med																																							*Adriatic/East Med.*
Venice			4																							7			5						7			23	Venice
Trieste/Montefalcone			5														1	2		1						13			6	1					10			39	Trieste/Mont.
Koper																														1								1	Koper
Taranto																														1								1	Taranto
Malta			2					2																				1										5	Malta
Piraeus	1							3										1						1					1	1	1							9	Piraeus
Thessaloniki								1										1																				2	Thessaloniki
Izmir								1					1					1																				2	Izmir
Lattakia								2																														2	Lattakia
Mersin								2																														2	Mersin
Larnaca/Limasol								1										1																				2	Larnaca/Lim.
Beirut	4		4					3	2		4				1													5	6				1					30	Beirut
Haiffa								1					1					1																				3	Haiffa
Ashod								1																														1	Ashod
PortSaïd								1													1				1													4	PortSaïd
Damietta					7																	5				4		6	4		1					4		31	Damietta
Dekheila																						9																9	Dekheila
Alexandria	4		8				4	2	1	8			2		1			2			2	3				1		3	4		1				1			47	Alexandria
Benghasi																													4									4	Benghasi
Black/Marmara seas																																							*Black/Marmara seas*
Odessa								2																														2	Odessa
Constanza																		2			2							3	6									13	Constanza
Varna								1																														1	Varna
Istambul								1										1																				2	Istambul
Gebze/Gemlik	4		4				5			2																		3	10									28	Gebze/Gemlik
	17	**1**	**27**	**6**	**7**	**5**	**13**	**38**	**7**	**31**	**22**	**4**	**4**	**6**	**7**	**2**	**4**	**23**	**6**	**2**	**29**	**27**	**4**	**3**	**10**	**38**	**1**	**56**	**64**	**7**	**8**	**3**	**3**	**1**	**18**	**15**	**5**	**524**	

Some caution must be expressed concerning the figures presented in Table 3. The more important concerns the frequent occurrence of multi-porting : the same ship calls successively during the same voyage in several Mediterranean ports, and each call is accounted for. This results in inflating the number of calls in the destination area as compared with the number of voyages towards it. Reciprocally, outside this area, such a ship is counted not only at ports of departure but also at the intermediate ports of call.

Nevertheless, such a bias has a technical justification : the sea-water loaded at the port of departure in the ballast tanks of a given cargo liner will not generally be completely discharged at the first port of call. Partial discharges occur in successive ports of call when adjusting ballast to the balance between unloaded/ loaded cargo weight . The best example of regional multi-porting is provided by the service of Troy Shipping Line between New York and the Mediterranean/Black seas area: following a last outside call at Tangiers, the vessels operated by this company visit successively a great number of the ports of the destination area.

Also, it should be emphasised that the type of commercial information gathered from this source cannot be considered as a valid statistical analysis of official port data. The various port listings have to be considered carefully to eliminate double or multi-counting of calls. Due to slot sharing arrangement between container shipping companies, two or more different voyages for different shipping companies or consortia are mentioned when only a single vessel is actually calling. In several occurrences, it has also been found that the same ship is mentioned twice because her scheduled arrival day was modified and a new entry was introduced without suppressing the first one. A serious loophole was found as no voyages were reported during the September/October 2002 reference period for both Venice and Trieste. Consequently the figures presented in Table 3 for these two ports are those displayed on the site for the following November/December two-months period. It was considered that the regular pattern of the cargo liner vessel calls authorizes such a reference period substitution, in order to get an overall regional picture.

Fig. 1. The container ship *Alva Star* grounded at the bottom of a clift of the Greek island of Zakinthos.

Discrepancies have also been found between data of origin considered in an arrival port with corresponding data of destination listed in a departure one. Therefore, despite the fact that the free access to and immediate availability of such information present great advantages, their reliability is somewhat questionable.

As an example, I shall mention the *Alva Star* case: this container ship of the Norasia shipping company engaged in a US West Coast/Far-east/Mediterranean Service is given by the Shipguide data bank consulted on 17/10/02 as having called at Alexandria on the 14 October at the end of her "Mediterranean tour" when in fact this tour was abruptly and unhappily terminated on October 3 when she ran into a 100 m high cliff of the Greek island of Zakinthos (see Fig. 1). Obviously, a lot of further and time-consuming checking processing would be required if such type of commercial information is used for a scientific study of regional ship movements.

Despite these drawbacks in the accuracy of its data base, Table 3 supplies an useful overall view of the current cargo liner shipping pattern along the world maritime routes leading to the Mediterranean Basin, enabling to present the following comments:

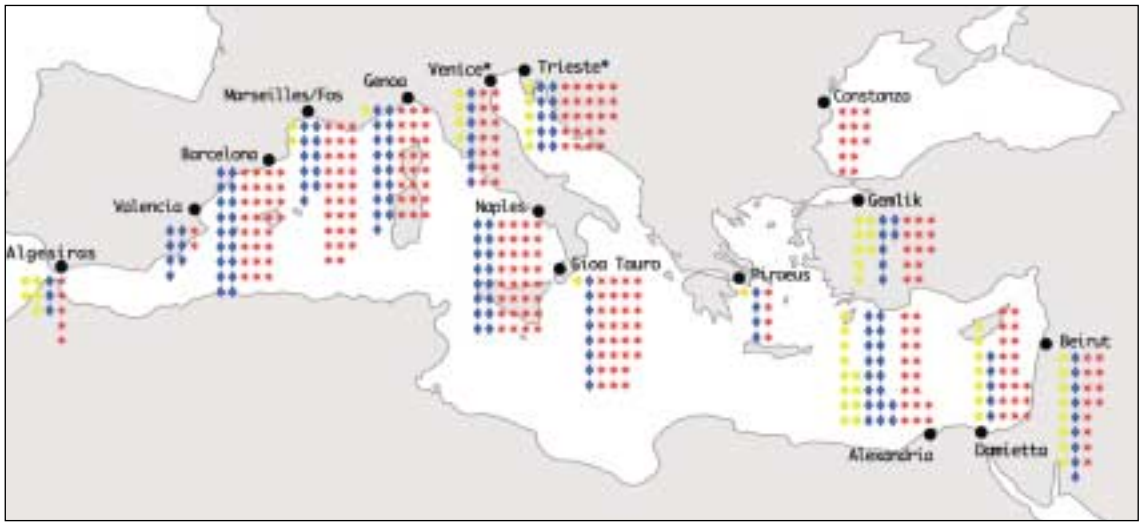
1) Among the 38 ports concerned, only nine have registered 30 or more arrivals during the two months observation period:

- five in the North-West Mediterranean Basin:
Barcelona, Marseilles/Fos, Genoa, Naples and Gioia Tauro;
- four in the South-East part of the same basin (when including Adriatic Sea):
Trieste/Montfalcone, Beirut, Damietta and Alexandria.

As shown on Chart 3, the major Italian ports are playing a capital part among the area destinations. No major destination points can be found in the Black Sea region, although the Turkish ports group of Gebze/Gemlik stands just below the defined limit.

2) Only three other ports, Algesiras, Venice and Constanza, have registered more than 10 and less than 30 arrivals during the observation periods. It can be seen on Chart 3 that the

Chart 3. Major Mediterranean ports of call for cargo liner vessels showing voyages distributed by main climatic zones of origin.



Each point corresponds to a call scheduled during the autumn 2002 observation period of vessels arriving from:
1) NE Europeans waters : yellow
2) Other temperate climate waters : blue
3) Tropical waters : red

** The data were missing for Venice and Trieste when this chart was initially established according to information collected in mid-October on the Internet site ShipGuide.com for the September/October 2002 period. The data inserted later for these two ports correspond to the November/December 2002 period for which the information became available in November.*

cargo liner trade is economically concentrated in a few places but geographically spread over the Mediterranean Basin and the adjacent Marmara Sea. Black Sea ports are not much directly served by intercontinental services as their container trade is mainly serviced by feeder vessels after trans-shipments in a Mediterranean terminal.

3) The ports of departure of the service calling at Mediterranean ports are widely spread over the planet. They number 48 but some grouping has allowed to limit to 37 the number of corresponding columns.

4) By far the more important origin of the considered services is the Malay Peninsula with more than 100 departures, about equally divided between Port Keelang and the group formed by the port of Singapore and its nearby and recent rival in Malaysia, Tanjung Pelapas. However, many container ships have called at Port Keelang after having departed from Singapore. Indian Ocean (specially Columbo) and Red Sea ports are also important intermediate call for the lines serving the Mediterranean region. Brazil also plays a non negligible part among tropical origins.

5) Regarding the departure ports located in temperate Atlantic waters, it is worth to underline that those located on the East coast of the USA are a far more important origin for Mediterranean services than the North-West European major "container traffic hubs" such as Bremerhaven, Rotterdam and Felixstove.

6) It is recalled that many of the larger post-panamax* container cargo vessels employed on scheduled lines linking major N-W European and some US West coast ports to ASEAN and Far East ports are crossing the Mediterranean between Gibraltar and the Suez Canal without calling at any port of the Basin. Therefore they have not been taken into consideration for the present analysis although they may be vectors of aliens unwanted marine species, specially among the hull fouling ones.

7) Finally, the liner cargo vessels visiting Mediterranean harbours and having their departure ports on the USA West Pacific coast generally belong to one of the "Round the World services". All have called at one or more intermediate ports located in Asia before reaching the Mediterranean Sea by the Suez Canal. Thus the proportion of temperate climate ballast water loaded before their initial sailing is largely diluted in tropical waters pumped in the China Sea, Indian Ocean and Red Sea along their route so as to adjust the ballast volume to the changes in the cargo weight intermediate. Also the chance to find surviving would-be invaders from the North-West Pacific area in ballast water discharged in a Mediterranean harbour is for most species greatly reduced by the great length of the trip.

CONCLUSION

The overview just presented of the shipping relationships between the Mediterranean/Black seas area and the rest of the world provides only a very preliminary approach to the possible location of the "source" and "sink" areas of ship-transported alien species likely to provoke unwanted or dangerous bio-invasions in the region. Naturally, this area can be as well the source of similarly damaging events in many other parts of the "Seven Seas".

Apart from the geographical aspect of the routes followed and calls effected, technical factors, linked to the type and size of the concerned vessels as well as their operational constraints, must also be considered. At the global level for ballast water, these factors are dealt with within the terms of reference of IMO "Globallast" program. To apply them to the shipping patterns of a given region would require a very detailed cross-analysis of the shipping movements, ships' particulars and shipped cargoes which is not yet possible in the current unsatisfactory context of the maritime statistics.

This is precisely why the author has recommended the building-up of a Mediterranean Maritime Statistics Observatory to agencies such as UNEP/MAP and MEDSTAT.

*" *post-panamax" refers to vessels too large to cross the Panama canal*