WWF

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Summary of results Life Linda 2003 – 2007

Limiting Negative Interactions between Dolphins and Human Activities

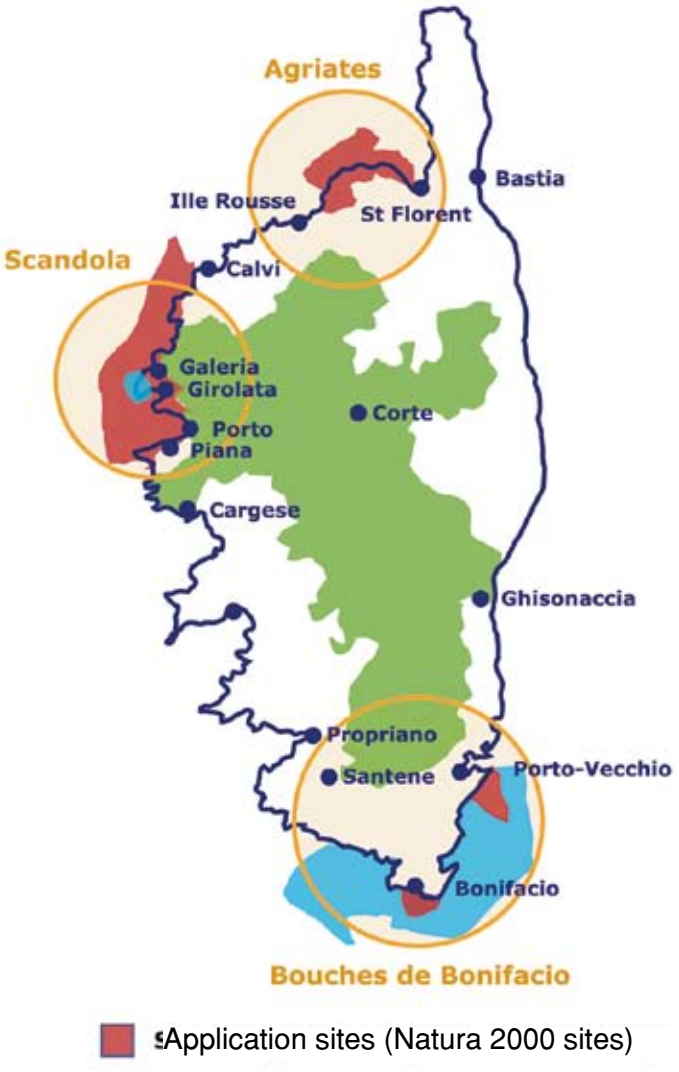
LIFE LINDA ISSUES, ACTORS AND ACTIONS

Humans and Bottlenose dolphins have always occupied the narrow continental shelf together more or less in harmony. Dolphins are friendly when they swim in the wake of ships, but are also fierce competitors for the fish stocks sought after by fishermen and when they get caught in the nets.
In 2000, within the context of its «Cap Ligures» programme for the conservation of Mediterranean marine mammals, WWF-France took an inventory of Bottlenose dolphins in Corsica. The scientists involved in this work sounded the alarm: the exasperation of fishermen, facing increased attacks by Bottlenose dolphins in their nets, had reached a critical point. These testimonies matched the scientific observations of Corsican marine protected areas.

BOTTLENOSE DOLPHINS AND FISHERMEN: RESTORING THE CONDITIONS FOR HARMONIOUS COHABITATION BETWEEN HISTORICAL COMPETITORS

In reply to this information, WWF-France launched the Life LINDA programme in 2003. Its objective is to protect the populations of Bottlenose dolphins off Corsica, by restoring the conditions for harmonious cohabitation between economic activities and this protected species. This involves associating the main actors in environmental management, socioeconomic representatives, local populations and pleasure boaters in the implementation of sustainable practices for fishing and nautical activities.

The programme took place at four Corsican Natura 2000 sites registered under the heading of the Bottlenose dolphin: Agriate in the north-west, the area around the Scandola nature reserve in the west and the Bouches de Bonifacio Nature Reserve including the Cerbicale Isles and the Lavezzi Isles which are Natura 2000 sites. This localisation of the programme's activities, required by the Life financing regulations, is not the most pertinent for this species which has a far vaster radius of activity, particularly when it comes to studying populations. However, these three sites cover a large part of the species' territory in Corsican waters.



THE ACTIONS

The actions undertaken as part of the Life programme are designed to respond to the different dimensions of the problem, notably:

• The acquisition of knowledge: identifying and monitoring populations, measuring noise pollution producing an action plan, etc.

• Implementing measures to reduce conflict between Bottlenose dolphins and the fishing industry: working with fishermen to devise strategies for avoiding Bottlenose dolphins, testing alternative fishing techniques, producing economic assessments of the cost of modifying fishing techniques etc.

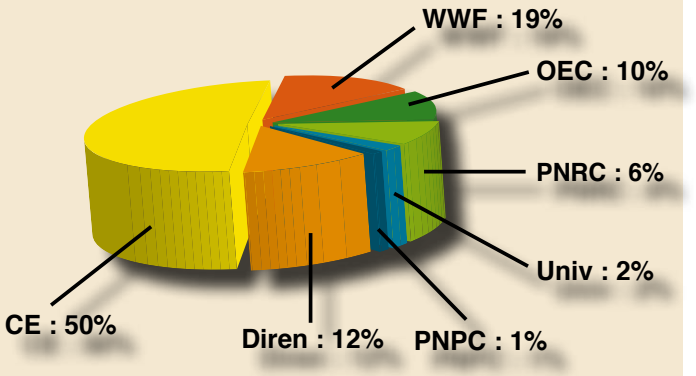
• Carrying out activities to promote sustainable methods of management of nautical tourist activities: monitoring whale watching, producing a code of good behaviour, poster and brochures with recommendations, inclusion in courses for coastal boat licences, campaigns to inform pleasure boaters etc.

• Raising the awareness of children and the general public: educational kit, discovery classes, television documentary, conference-debates etc.

Programme partners

• 5 financial and technical partners: The Corsican Office of the Environment (manager of the Bouches de Bonifacio Nature Reserve), the Corsican Regional Nature Park (manager of the Scandola nature reserve) and the Port-Cros National Park (manager of the French part of the PELAGOS Sanctuary) and the University of Corsica.
• 2 co-financiers: The European Commission through the LIFE financial instrument for the environment, and the Corsican Regional Environment Department (DIREN Corse).

Distribution of partner's financial contribution



Life LINDA in figures

• 1 000 days of missions at sea
• more than 8 000 nautical miles (15 000 km) covered
• operations over more than 150 000 marine hectares
• 20 employees in different structures and fifty volunteers have helped Life LINDA
• 225 Bottlenose dolphins observed, including 117 dolphins photo-identified and recognisable
• more than 15 000 pleasure boaters provided with information
• more than 7 000 children provided with information by instructors
• cooperation with thirty professional fishermen

Bottlenose dolphin population

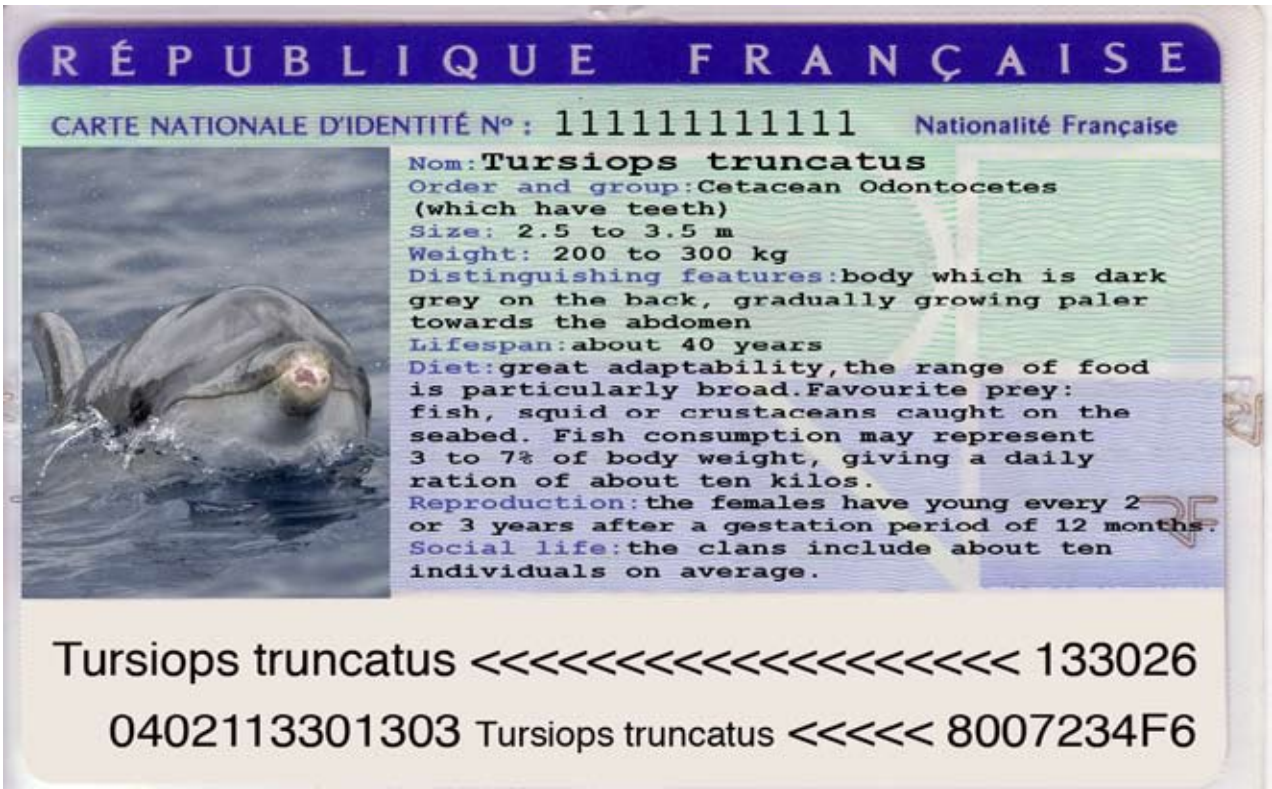
THE BOTTLENOSE DOLPHIN

The Bottlenose Dolphin is found throughout the world in tropical and temperate waters. In the Mediterranean, the species was widespread until the mid-20th century on the northern edges of the western basin. The 1940s marked the start of a steep regression in this area and today Bottlenose dolphins are only found in significant numbers in the western basin on the southern edges of the Mediterranean, the banks of the Alboran sea and Catalonian sea, the Tuscan archipelago, the Gulf of Lions where it seems to have returned since the end of the 1990s, and around the large islands: Sicily, the Canaries, Sardinia and Corsica.
In Corsica, there are communities all around the island but fewer on the eastern side. Bottlenose dolphins are generally encountered in groups of about ten, rarely more than 20.

The favourite habitat of the Bottlenose dolphin (*Tursiops truncatus*) is the continental shelf between 0 and 200 metres depth, which makes it the cetacean which is closest to humans. This proximity has led to it being known and sometimes famous: it is the star of «Flipper», a famous TV show, and found in many theme parks. It sometimes takes the initiative in approaching humans, because most of these so-called dolphin «ambassadors» which choose human company for a while in preference to that of their colleagues are Bottlenose dolphins.

However, it is also the species most exposed to all kinds of human activities. Like all its fellow members of the species, it is suffering the chronic impact of all our pollution, the long-term effects of which are still insufficiently studied.
Excessive nautical intrusion disturbs its activities and social behaviour and there is a significant risk of collision, particularly for the young. Maritime traffic is also a source of sound pollution with negative effects on animals whose world is essentially acoustic.
Cetacean watching, though basically well-meaning in intention, can also become a nuisance if it is not regulated and does not respect a strict code of conduct.

The Bottlenose dolphin is in direct competition with humans in exploiting coastal fish resources and this coastal strip is particularly narrow in Corsica. They are intelligent animals so it is rare to see them caught in the nets. On the other hand, they have learned to use them for their own benefit and sometimes eat directly from them, tearing the nets and angering the fishermen.



POPULATION FIGURES

In Corsica, three Bottlenose dolphin censuses, taken by the GECEM in 1993, 2000 and 2003 (127-154; 153-212; 130-173 individuals respectively) suggest a total of about 200 individuals. The uncertainty linked to the method and variations in weather conditions impose fairly broad limits but the Corsican population can be considered to have been stable during this time.

Within the context of Life LINDA, the objective was to monitor, on a smaller scale, the populations at Natura 2000 sites at Saint-Florent, Galeria and Bonifacio (table below) during bimonthly trips, a rhythm that weather conditions did not always allow us to achieve.

A total of 135 clearly marked dolphins have been identified along the Saint-Florent and North-West coast, 26 being common to both areas. Two of the Saint-Florent dolphins were observed before the Life in other sectors, three on the western coast have been seen again in the south and two were known from Saint-Florent in 2003. These data show the very broad use the dolphins make of this area which is arbitrarily split up in the Life study: in reality, there are so many exchanges between the two areas, including females with young, that they must be considered to be used indifferently by a certain number of dolphins at least a significant number of dolphins. 70% of the well-marked dolphins identified in either of these two sectors gave rise to a recapture in this vast area, a figure which can be taken as an approximation of the number of sedentary dolphins, i.e. 95 individuals.

These results show that the small size of the Natura 2000 site is not pertinent in monitoring the demographic evolution of the Bottlenose dolphin population in Corsica and so this must rather be envisaged for the entire island.

Table 1 - Number of trips and number of dolphins per site. The «clearly-marked» dolphins are those we are certain to recognise. The others are differentiated within a given group but are not well enough marked to be identified with certainty under other circumstances. The «recaptured» dolphins were seen several times, either at the same site (first number) and considered to be sedentary, or at another site (second number).

	Saint-Florent	Galeria	Bonifacio
Number of dolphins	96	127	67
Clearly marked @	64	92	21
% Clearly marked	65,7%	72,4%	31,3%
Recaptured	49	74	9+2

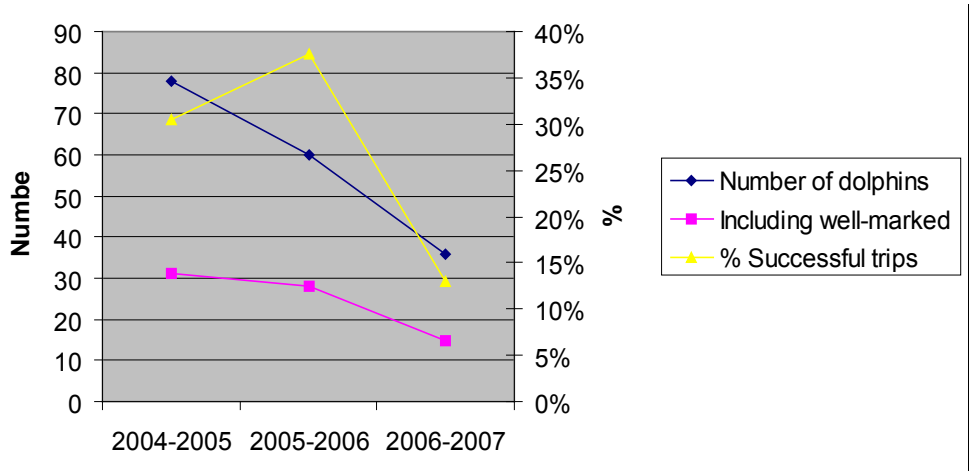


Figure 1 - Evolution of observations of Bottlenose dolphins at Saint Florent

EVOLUTION OF SITE FREQUENTATION

At Saint Florent where most of the sampling was done, there is a trend concerning site frequentation even if it is not statistically supported. It is negative: for an increasing number of trips during the last season (23, 16 and 31), the number of successful trips, meaning when dolphins have been observed and well photo-identified, was constantly dropping.

Two causes are envisaged to explain this trend:

• The blasting of a whale on 21 May 2005 in the middle of the Bottlenose dolphins' habitat under high questionable conditions (much too shallow). This operation was followed by a very long period without observation.
• Overfishing of fish stocks, but no scientific study is available to support this hypothesis.

At Galeria and Bonifacio too few trips were made to be able to draw any conclusions on the evolution of frequentation. However, inter-site comparisons of the results of the missions performed over the same period suggest that Galeria is particularly frequented and important for the species.

DEMOGRAPHIC PARAMETERS

In the Bottlenose dolphin, gestation lasts twelve months and females of reproductive age (generally between 10 and 40 years old) only give birth to a single baby every 2 or 3 years or even 3-4 years.

During our study, mating was only observed on 1st May 2005 and 17 April 2007, in the Saint-Florent region. However, if we consider the dates at which mothers were seen with very small young, about a year after mating, the reproductive period appears to be fairly centred during the warm season, from mid-July to mid-August. Data on beached newborns tempers this vision which seems to be too schematic for this highly social species and shows that mating can take place throughout the year. At least thirteen births were verified during the Life LINDA study and for most of them, an interval of 3 years between births was confirmed.

Analysis of observations of mothers with their young shows the high level of interest in the Galeria region, because over the three years of the study, no less than 15 accompanied females were observed there, against only 5 at Saint-Florent.

MOVEMENTS

Most Bottlenose dolphins are fairly loyal to a favourite site, but they can also move rapidly over long distances.

Many dolphins in the Agriates region (Saint-Florent) were observed there on numerous occasions over more than 10 years. The record is held by a female who was photographed for the first time in 1993, then seen again ten times at the same site. It was then identified again in 2006 and 2007, but this time at Galeria.

Other dolphins circulate along the north-west coast of Corsica and have been seen on many occasions between the northern tip of Cap Corse and the Scandola reserve (Galeria), at intervals of a few days to a few weeks. A dolphin known as «Romain» because he is often seen around the aquaculture farm in the Gulf of Ajaccio, was identified at Figari, 70 km away in the south of the island, two months later.

Finally, some of them are long-distance travellers. Three clearly identified dolphins created a great surprise by each demonstrating their ability to swim to the mainland and back. But it is all the more remarkable that these three adventurers were observed together in the middle of the Corsica Channel in July 2006. They may be males who gather in small moving groups to go and disseminate their genes elsewhere. Their use of the Corsica channel supports the hypothesis whereby they use a coastal route rather than the direct route above deep water.

These movements give the dolphins a chance to move from one group to another, meeting other dolphins for short periods without any observable structure or stable social links.

Dolphin CERB-02

Dolphin PC-25

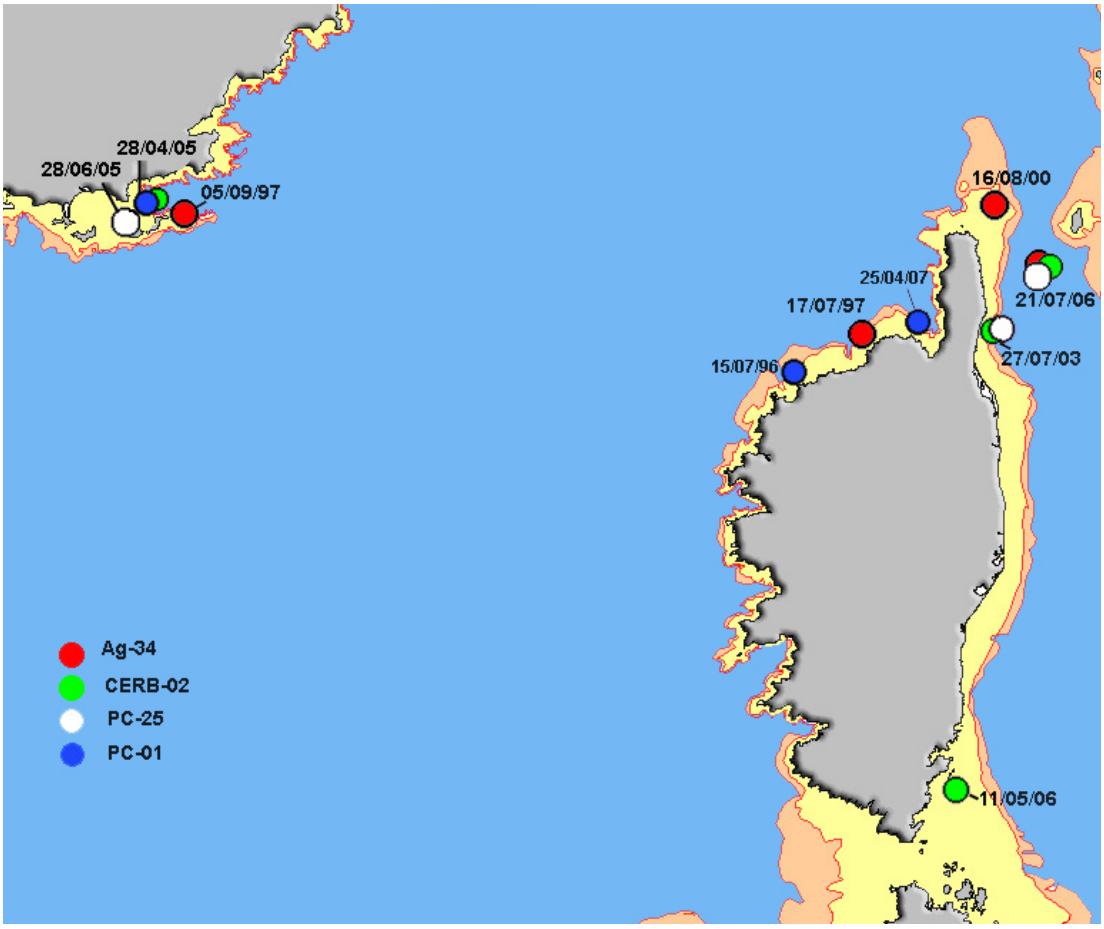


Figure 2 : Map of successive sightings of Ag-34, CERB-02, PC-25 et PC-01 (Données GECEM, WWFFrance, Parc National de Port-Cros, ONCFS, Nice Matin et Participe futur).

Dolphin PC-01

Dolphin AG-34

DIET

The Bottlenose dolphin's diet was not specifically studied as part of the Life LINDA study, but it was interesting to compare the data given in the literature concerning the species' preferred prey with the data collected from attacked nets.

It is amazing to note that the five most frequently consumed species in fishing nets Mullet (*Mullus surmuletus*), Bream (*Pagellus erythinus*), Forkbeard (*Phycis phycis*), Barracuda (*Sphyraena sphyraena*) and Corb (*Sciaena umbra*) do not appear, or only very marginally for bream in the 1492 prey fish found in 47 Mediterranean Bottlenose dolphin stomach contents, even when limited to animals from Corsica.

It can therefore be concluded that the Bottlenose dolphins' favourite species are not species of high commercial value and that samples taken from nets reflect opportunism rather than the basic needs of the species.

PREFERENTIAL ZONES

In the Saint-Florent zone, Bottlenose dolphins have been observed in all types of environment, particularly sandy bottoms, which predominate almost everywhere and house their favourite prey, the Whiting. But by superposing all the routes observed, certain types of preferential seabeds emerge: sub-outcrop rocks surrounded by sand; gravel bottom surrounded by rocky outcrops or sand. Isolated rocky outcrops, habitat of the Conger eel, are very regularly visited also.

Generally speaking, it seems that the Bottlenose dolphin appreciated mixed facies or interface zones between two environments, which are also zones where there is a greater diversity and abundance of fish.

There is no correlation between the zones most frequented by dolphins and the sectors where most net attacks occurred. Saint-Florent, for example, the zone where dolphin occupation was the most uniform is also the one where net attacks were lowest (2% of catches). Reciprocally, the sector with the largest area attacked and the highest percentage of net attacks was the one where the smallest number of dolphins were observed.

The conclusion is that humans and cetaceans just happen to exploit the zones with the highest populations of fish. Bottlenose dolphins are opportunistic predators; if they find a full fishing net, they will take food from it without confining themselves to these fishing areas.

Limiting interaction between dolphins and local fishing

The question of interaction between the Bottlenose dolphin and fishing is at the heart of the Life LINDA in order to study. To try and provide a satisfactory response to the growing tension between the Corsican fishing community and the Bottlenose dolphin, a protected species. This problem had to be approached in several stages:

1 – Quantify the degree of interaction objectively.

2 – Assess the impact of this interaction on fishing revenues, whether in the catch in their nets or the damage done to them.

3 – Define practical alternatives which would limit this interaction.

Concerning this last point, it is important to remember that the Life LINDA study originally intended to install acoustic deterrents which were found to be ineffective. A study performed in Corsica before the start of the Life study, clearly demonstrated this, in coherence with many other studies and testimonies based on similar experiences.

IS THE INTERACTION BETWEEN THE BOTTLENOSE DOLPHIN AND FISHING SIGNIFICANT?

To answer this question, 1075 nets were studied during 386 sea trips in 2004, involving 27 fishing boats and 4 «Prud'homies» (areas managed by fishing institutions), covering the three sites involved in the Life LINDA study. It can therefore be considered that these results give a reasonably reliable image of the size of the problem.

On average, in Corsica, 11% of the nets studied had been attacked by dolphins. This average masks some significant variations according to site (Table 2). At Bonifacio and Galeria, further data were added in 2005 and 2006 giving an average of 13%, not very different.

Although the percentage of nets attacked is scientifically the most appropriate for assessing interactions, the percentage of attacks per trip (a fishing boat may use several nets per trip) is more representative of what is «perceived» by the fishermen and provides a better explanation of their exasperation.

From this point of view it seems that, depending on the site, fishing nets have been attacked by dolphins every 4 or 5 fishing days. This seems to us to be significant and justifies consideration of this interaction in fishery management.

Analysis of these data also reveals the influence of certain variables on the frequency of attacks which is highest:
- in high production nets
- in small mesh nets (mesh > 9, 9 is the number of knots per 25 cm)
- in nets set between 25 and 50 metres deep.

Table 2 - Frequency of attacks in the 4 «prud'homies» studied. The Galeria application site straddles two of the «prud'homies». * : statistically significant difference.

Prud'homie LINDA site/ main port	Bastia Agriate Saint-Folrent	Balagne Scandola Galeria	Ajaccio Scandola Galeria	Bonifacio Bouches de Bonifacio Bonifacio	Average
% Nets	10,5%	12,7%	5,9%	16,7%	11%
% Trips	22,3%	26,4%	13,9%	27,8%	21,5%

DOES THIS INTERACTION HAVE AN IMPACT ON FISHING NET PRODUCTION?

The following results are based on the analysis of data from 1102 fishing information sheets representing the same number of nets, about 500 m long, collected during 285 days of sampling over 3 fishing seasons (2004, 2005, 2006). 85% of the sampling effort was expended at the Bouches de Bonifacio site and the rest at Scandola. This data set differs from the one used to assess the frequency of attacks, presented above and was limited to 2004.
In the results presented here, «waste» refers to fish found in the nets which are unsaleable because they have been damaged by the dolphins or by other causes such as fleas, conger or moray eels. The measurement used for analysis is «Capture Per Unit of Effort» (CPUE), in grams per 50 m section of net per day.

Waste linked to dolphins

The total waste (dolphins, fleas etc.) represents 9% of total CPUE, of which waste imputable to dolphins («dolphin waste») was 8%, which is 0.75% of the CPUE for all the nets sampled (attacked or not).

If we consider only nets which were attacked the waste due to dolphins represents 82.1 g/50 m/day, i.e. 6.4% of the mean CPUE of these nets. This value represents what remains in the nets and not what was taken by the dolphins. It is therefore an under-estimate.

Of the 15 species whose waste is attributed to Bottlenose dolphins, 3 species (mullet, bream and forkbeard) alone represent 57% of the «dolphin waste». These commercially valuable species are also the most targeted by fishermen, but they are not part of the Bottlenose dolphin's usual diet.

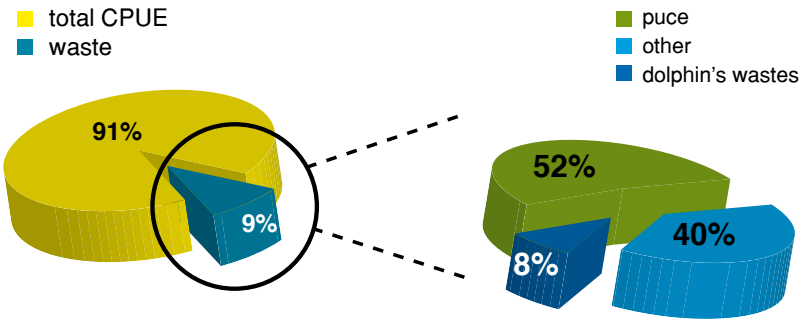


Figure 3 - Proportion of waste in the total CPUE

Impact of attacks by dolphins on net production

To study the variations in production in the presence of Bottlenose dolphins, we have defined two types of interaction: the presence of dolphins in the fishing sector and the presence of «dolphin waste».

In both cases there is no significant fall in biomass caught. On the contrary, we noted a significant increase in CPUE both with direct attacks and in the simple presence of dolphins on the site (Figure 4). This is a reverse verification of the study on the frequency of attacks, which had shown a positive correlation with «high production variable».

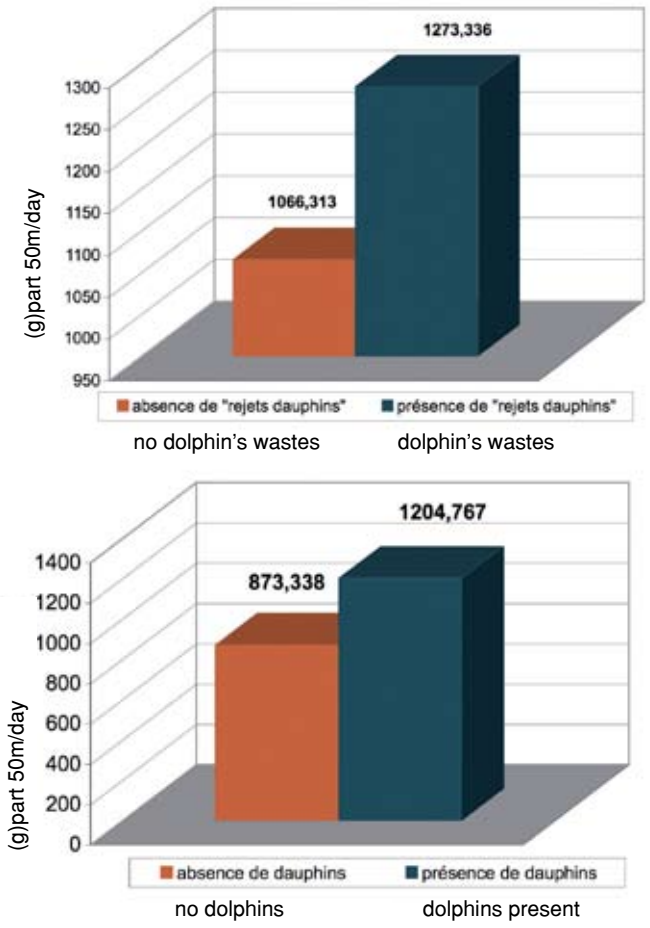


Figure 4 Variations in CPUE according to the two types of interaction with dolphins (presence on site, presence of waste)

The answer to our question is therefore negative. Two hypotheses can support this result without it being possible to decide, given the current state of knowledge:

• The first would be that Bottlenose dolphins use the nets as hunting targets and deliberately kill the fish in the nets by scaring them. This hypothesis is supported by the gregarious behaviour of the species which show significant increase in numbers in the event of interaction. The shoals of bream, mullet and bonito therefore rush into the nets «chased» by the predator

• The second hypothesis is that humans and dolphins are found together on sites frequented by the most fish, where the nets are more productive and the dolphins take advantage of this opportunity.

WHAT IS THE IMPACT OF THIS INTERACTION ON FISHING NETS?

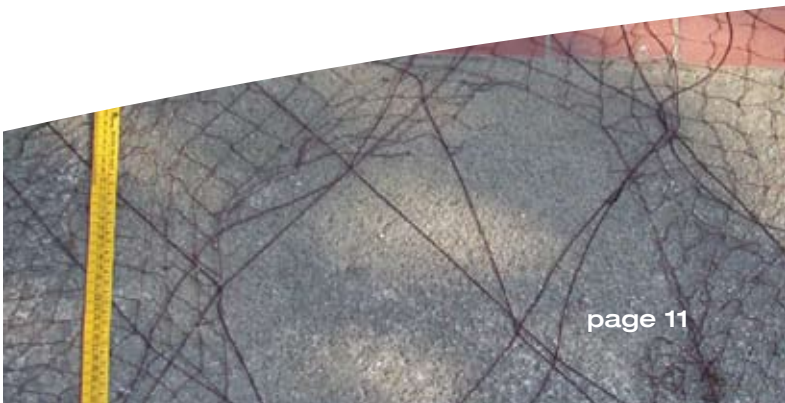
To assess the speed and degree of damage to nets following dolphin attacks, experiments were performed on new nets. During the 2006 season, 14 boats were equipped with new nets which were examined after each trip.

When taking the fish, dolphins tear part of the central layer of the nets which are then very difficult or impossible to repair. This monitoring is based on a type of damage based on scientific experience and expertise which can be used to distinguish between damage caused by dolphins (called «tongue» because of its shape) and that caused by conger and moray eels or by catching on rocks.

The average size of a «tongue» is 20 cm . It was estimated in agreement with professionals that this hole reduces the net's «fishing» area by 1 m .

During experimentation, the average number of holes per attack was 9, i.e. 9 m , i.e. 180 m in 20 attacks. At this stage, the fishing area of the net is reduced by a quarter and its production falls by one third (CPUE=1864.7g/50m/day for a new net compared with 1196.8/50m/day for a used net) which means it has to be replaced.

For a 180 day fishing season, there is an average of 35 days when the nets are attacked, which means the loss of two nets.



WHAT ALTERNATIVE FISHING SOLUTIONS ARE THERE TO LIMIT THIS INTERACTION?

Three alternative fishing methods limiting this interaction have been selected on the basis of tests and an economic assessment made of the change to this new system:

- abandon mesh sizes 7 and 9 and use size 5
- change to 12h hauls rather than 24h hauls
- change equipment and use longline.

Increase the net mesh

Nets with mesh 7 and 9 (the smallest) are the most frequently attacked, but they are also the most productive. Mesh 9 in particular records a higher CPUE than the others, particularly concerning the mullet (8 times that of mesh 7), a species targeted by fishermen and also much appreciated by dolphins.

However, analysis of the economic profitability of using mesh 5, 7 and 9 shows that while 9 meshes catches quantitatively most fish, with mesh 7 nets selecting catches while higher sales prices that are more profitable from an economic point of view.

Mesh 5, with CPUE only half that of mesh 9, has an equivalent economic profitability because it preferentially catches species with higher commercial value.

On the other hand, abandoning mesh 7 for mesh 5 leads to a loss of earnings of about 15%.

Mesh 5 has several advantages:

- Fewer attacks: only 3% versus 21% and 10% for meshes 9 and 7.
- 75% of fish caught are species of high commercial value.
- It targets large adults which supports better management of fish stocks.
- It is easier to release which reduces working time per section of net.

Change to 12 hours hauls rather than 24 hours

At Bonifacio, nets hauled at 24h are significantly more frequently attacked than nets hauled at 12h. Even if this is no longer the case, if we group data with that of the Scandola site, it is interesting to assess the compared profitabilities of these two methods.

There is no significant difference between the total mean CPUE for a net hauled at 12h and a net hauled at 24h (1031 g/50m/day versus 1154g/50m/day). However, certain species are more likely to be caught with 24h hauls, such as the bream (Pagellus erythrinus) or the scorpion fish (Scorpaena scrofa), whereas the opposite applies to the wrasse (Labrus viridis) for example.

12h hauls need two round trips per day to the sector concerned, which doubles diesel costs. Considering the fleet characteristics and fishing practices in the Bonifacio sector, this extra cost is estimated at 20 of diesel per day of fishing, which is considerable when calculated over a month of fishing. It is more realistic to consider that changing to 12h hauls is only envisageable if fishing sites closer to the port are chosen, which is not always possible.

Change to longlines

This system, although very profitable, is not widely used in the zones covered by the Life LINDA programme. It is the most effective avoidance strategy with 0% interaction over the three years of sampling and is characterized by CPUE of large individuals which does not degrade juvenile stocks.

Over the two seasons 2005 and 2006, during which this system was tested, the average CPUE estimated was 15.2 kg for 100 hooks. The investment in accessory equipment needed for longline fishing is largely covered by one season of fishing. The purchase of a line hauler is the most costly investment. The real cost of this change of practice lies in an extra 2 to 3 hours of work added to the working day. It is also a fishing technique which requires a certain amount of experience, exploiting other types of seabed than nets and particularly dependent on weather conditions, which limits the fishing effort compared with that of nets.

THE CONCLUSION?

Contrary to what was hoped of acoustic repulsive devices, there are no miracle solutions to prevent Bottlenose dolphins coming to feed occasionally from fishing nets. Nevertheless, Life LINDA has helped quantify the extent of these interactions, determine their impact on fishing and suggest alternative practices which may limit them.

The Life LINDA project was carried out in association with all those concerned (institutions, fishermen, managers, associations, etc.) and in particular with fishing professionals who took part in its actions and shared its conclusions. In this sense, it is an excellent springboard to encourage the development of the alternative practices it has identified. The question of usable funds to finance this type of action is not solved however and must obtain solid support not only from public and local authorities but also form the EU.

It is important to preserve a diversity of fishing practices and avoid monofishing with mesh 5 trammel net or too many longliners, which would lead to an imbalance in captures to the detriment of the big carnivores.

Combined activities such as fishing and tourism (whale watching) could be encouraged on condition that the whale watching is well controlled (see next part). The dolphin would then no longer be a competitor but an asset in the development of «Pesca tourism».

The very positive impact of the Life LINDA programme on the relationship between fishermen and dolphins must be emphasised. The involvement of fishermen in our work, regular information on the progress of our results, consideration of their suggestions and finally, the attention paid to the difficulties faced by their profession, largely contributed to calm the tensions which were palpable at the start of our study.

It is also essential to remember that the Bottlenose dolphin plays an essential part in the marine ecosystem as a major predator. Any disturbance to its way of life and its biology would cause an imbalance in ecosystem functioning, of which the fishing industry would be the first victim.

Limit interaction betwen dolphins and boating

WHAT IS THE LEVEL OF SITE OCCUPANCY BY PLEASURE BOATS?

Occupancy of boats, with fishing, is an activity likely to have more or less directly negative effects on Bottlenose dolphins: risk of collision, disturbance, submarine noise pollution.
To evaluate this impact and envisage solutions, Life LINDA performed several studies intended to quantify both the level of occupancy of wetting zones and the intensity of traffic at the programme sites of application.

Strong and highly seasonal pressure

Counts performed In situ and from aerial photos were taken for sixty wetting sites, morning and evening, in the 3 sectors concerned by the programme. The results show the intensity of this tourist pressure, particularly in August, with more than 700 boats per day at Bonifacio, 400 at Scandola and nearly 200 at the Agriates (Figure 5). The differences between the sites are partly due to the number of anchorages available.

For all the sites, this average anchorage occupancy was three to five times greater for motor-boats than for yachts.

Boat traffic is also very high. Counting boats crossing a fictional line showed that on average in summer, more than 700 boats per day cross the Bouches de Bonifacio sector (Table 3). Forty-nine percent of this traffic is concentrated between 10:00 and 14:00 which is more than one boat per minute! Some particularly exceptional days also underline the highly irregular nature of this traffic: on 17 August 2005, 1,926 boats transited in the area of the Lavezzu islet. At Bonifacio, two-thirds of this traffic are motor boats whereas the proportions are more balanced at Scandola. In this sector there is very little traffic (8 times less than at Bonifacio) relative to anchorage intensity: Pleasure boats call in briefly from the northern and southern ports, but do not go out much from the western point of Corsica.

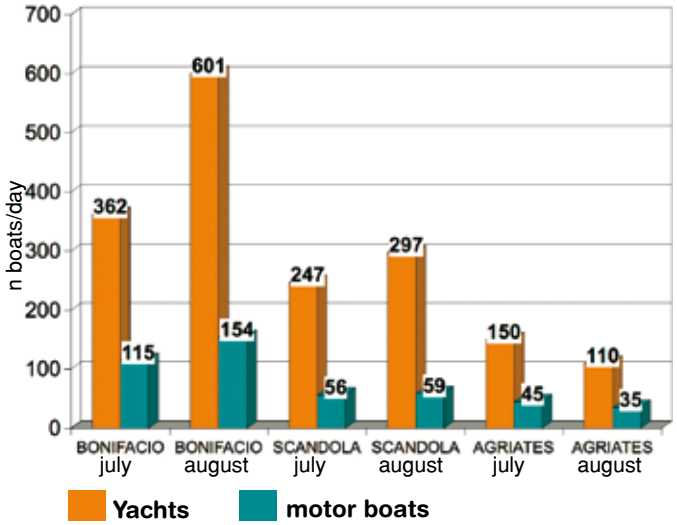


Figure 5 – Average number of boats at anchorages during the day, per day at the three study sites for the summer months.

« WHALE-WATCHING » : WHAT ARE THE RISKS TO THE ANIMALS??

Whale watching, if poorly undertaken, can cause changes in behaviour and even injury.

Although this is not widely practiced commercially in Corsica, there are many pleasure boats which do it individually occasionally. One of the objectives of the Life LINDA programme was therefore to assess and quantify the impact of these practices.

The groups observed generally consisted of 11 dolphins, with young in a quarter of the cases. The duration of watching was 17 minutes on average but sometimes went on for up to 50 minutes. The boats always deviate to get closer to the dolphins. In almost all cases they go to less than 50 metres from the animals at high speed, the average being 12 knots. These are essentially motor boats and jet skis. The latter can be particularly insistent and sometimes frankly aggressive.

Furthermore, watching a group of dolphins led to grouping and in 83% of cases 4 boats watching the same group of dolphins at the same time, with an observed maximum of 7 boats.
This behaviour does not in any way respect the recommendations of the good conduct code which must be applied in situations of marine mammal observation, particularly within the Pelagos sanctuary. It shows that we need broader communication and more public information on these good conduct rules with pleasure boaters.

Table 3 – Quantitative data on anchorages and pleasure boat traffic during the summer months at Bonifacio and Scandola.

	Bonifacio		Scandola	
Traffic				
	July	August	July	August
No. motor boats in transit	12195	17505	911	2402
No. yachts in transit	6006	8577	685	1441
Monthly total	18201	26082	1596	3843
Total for summer period	44283		5439	
Average motor traffic per day		564,55	29,38	77,48
Average yacht traffic per day		276,83	22	46,48
Anchorage				
Average motor boats anchored per day	265	278	362	599
Average yachts anchored per day	69	56	116	156
Average motor boats anchored per night	230	230	396	396
Average yachts anchored per night	79	79	99	99

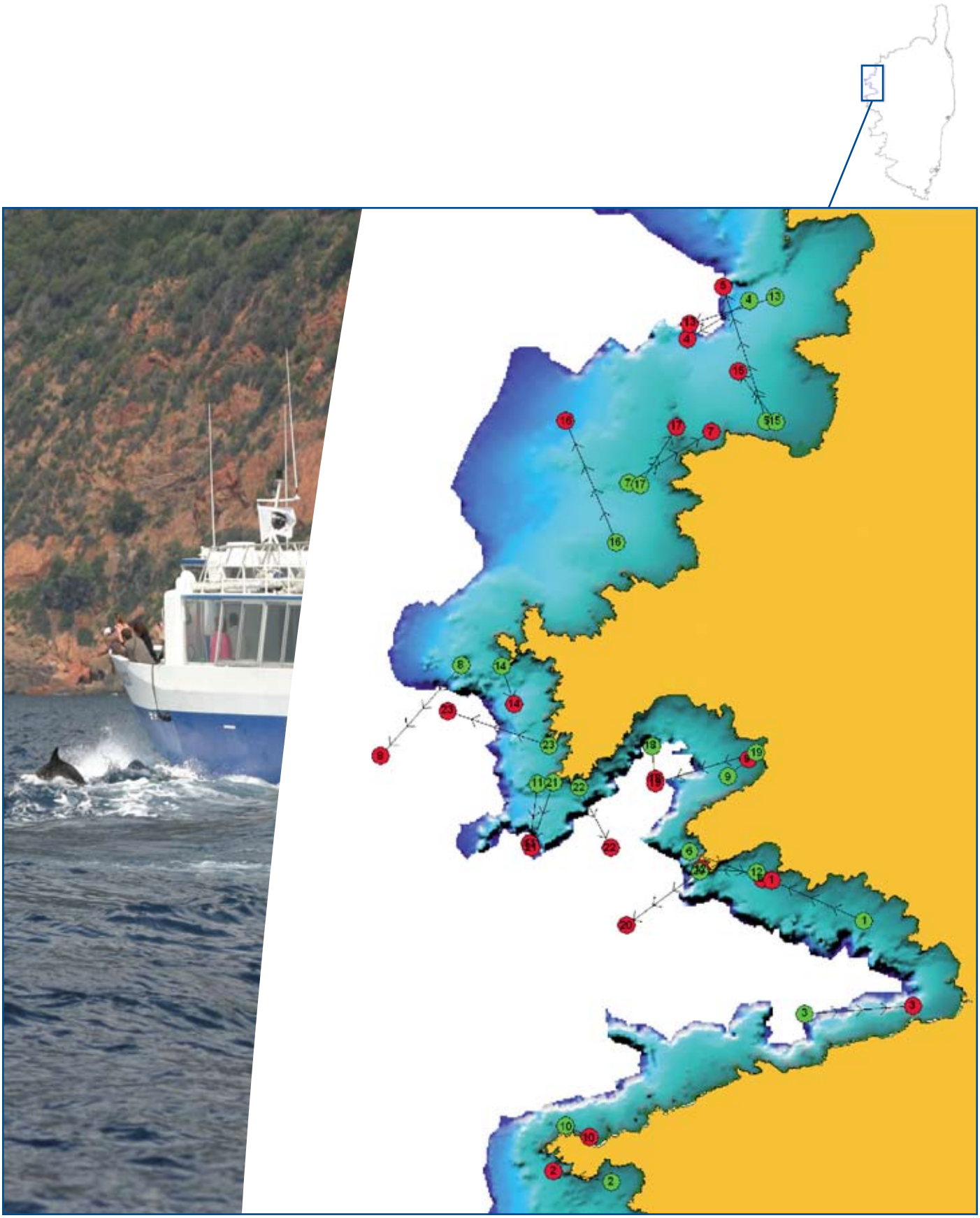


Figure 6: Location of interactions at Scandola: the distances covered during interaction are on average 2.32 Km but can go up to more than 5 km. Movement during interaction is towards deeper water in most cases.

The direct effects of whale watching identified were:

- fragmentation of groups (71% of cases observed)
- animals escaping and/or diving (85% and 68% of cases respectively).

The direct effects of whale-watching which were identified are group fragmentation (71% of cases observed), animals swimming away and/or diving (85% and 68% respectively). Dolphins rarely follow ships (only 18% of cases). Behavioural changes are much greater in the presence of motor boats and jet skis. In most cases, these interactions lead to the animals moving into deeper waters further out to sea where they find more peace.

All these observations reflect a change in the animals' behaviour, leading to disturbance of their rest and feeding periods.
In the longer term, poor management of this activity can lead to a fall in reproductive rate, desertion of environments which are optimal for survival of the species, or even direct physical risk of collision for the dolphins.

WHAT DEVELOPMENT CAN BE ENVISAGED FOR COMMERCIAL WHALE WATCHING OFF CORSICA?

There is very little commercial whale-watching in Corsica today (only 3 operators declared), but the growth potential is high. For ten years, Corsican fishermen have wanted to include this activity within the context of developing multiple activities and today, twelve of them are ready to complete their fishing business with this tourist activity. This diversification into «pesca tourism» would transform their traditional activity, which is now strictly seasonal, into a more important year-long activity.

But this development is subject to major legal and financial constraints. The status and regulations governing «pesca tourism» must be clearly and accurately defined to facilitate this multiple activity. Furthermore, the acquisition of more suitable boats for this type of activity (safety, alternative propulsion system, reduced power, etc.) could be supported for its contribution towards limiting fishing activities.

RECOMMENDATIONS

To provide for this growth and manage the activity correctly, the specificities of Corsican whale watching, notably its coastal aspect, must be included in the labelling project being developed by the PELAGOS Sanctuary, as well as in the good practices code.

Overriding the label project which prohibits activity within the five mile limit, we suggest tolerance of coastal observation but in return for a more restrictive code:
- Limited watching time;
- Prohibited zone extended to 100 m (compared with 50 m), including small delphinids;
- Definition of prohibited geographical sectors and times (= refuge zones), based on the Bottlenose dolphin's biology;
- Issue of official licences to limit the number of operators.

The definition of refuge zones for Bottlenose dolphins seems important to us and could be included in the regulations governing Corsican protected sites (reserves, reserved fishing zones, marine nature parks, etc.) and should apply to both professional operators and pleasure boaters.

Introduction of the «Whale watching» label which is being drawn up in Pelagos is also essential to supervise the development of this activity on Corsica. It must be certain that the means are available to ensure it will be respected and its proper application controlled by independent organizations.

If these conditions are met it will be possible to maintain and ensure the cohabitation of two valuable parts of the Corsican heritage: local fishing and Bottlenose dolphins.

Know more to love, love to protect

Raising awareness is one of the best ways of facilitating understanding of the issues involved in species conservation and promoting the application of sustainable behaviour and practices. Raising awareness has been defined in different campaigns, targeting children, especially schoolchildren, specific users such as fishermen and pleasure boaters and a wider public, including tourists on holiday in Corsica.

CHILDREN FIRST

An educational pack has been produced in 10 copies to facilitate the work of instructors and give extra drive to their presentations. The diversity of media concerned (CD-ROMs, 3D models, photographs, games...) means that these presentations can be adapted to all levels of schoolchildren as well as a broader public.

Class presentations took place over one or more days and in different geographic sectors (Ajaccio, Porto Vecchio, Cap Corse, the eastern plain, Balagne...) A total of 82 presentations given provided information for more than 5,600 children, mostly primary schools (66%) but also secondary schools (25%) and adults. As well as these classes, presentations were held at events (Mer en fête, Cap Mer, Festival du vent) which reached 4,000 people (children and adults).

Finally, discovery classes at Casa Marina (reception area in the Corsican Regional Nature Park) provided information for more than 1,500 children during one-week stays.

FOCUS ON PLEASURE BOATERS

Pleasure boaters are a particularly important target for the Life LINDA programme Indeed, noise pollution caused by boats or whale watching activities can be a source of disturbance for Bottlenose dolphins.
This is why a major information campaign was launched during three consecutive summers, with the help of 34 eco-volunteers. Their mission was to talk to pleasure boaters and holiday-makers in ports and pleasure boat embarkation points, inform them about the correct way to behave in the presence of Bottlenose dolphins and ask them about their behaviour and impact. Brochures summarising good behaviour and providing information about Bottlenose dolphins and their protected status were distributed at the end.

Talks were also given on training boats with coastal permit candidates..

Overall, the campaign reached 14,000 people for an average of 10 minutes presentation..

It also provided the opportunity to learn that although 50% of people know that there are Bottlenose dolphins in the Mediterranean, only 3% of them were conscious of the impact of pleasure boating on the species.

Contents of the pack

- cartoon story and card game on human/dolphin interactions
- Life size photo of a Bottlenose dolphin
- 3D anatomical model of a dolphin with retractable parts
- little figures of the main Mediterranean cetaceans
- Interactive game on magnetic panel: conservation issues within the Pelagos sanctuary in the North-Western Mediterranean basin

A useful campaign

A study performed afterwards by a private company showed that the campaign was very positively perceived by pleasure boaters. 99% of them felt that the information was very interesting, useful and easy to understand… Furthermore, 91% of them remembered the information received and 97% said it had led to their reflecting on their responsibilities and behaviour at sea.

A poster and three panels grouping recommendations on responsible boating were also displayed in tourist information offices, harbour master's offices and training boats.

INFORM FISHERMEN

Specific communication was also produced for professional fishermen. In addition to concertation meetings between fishermen and the programme operators to find solutions to the Bottlenose dolphins' intrusion, three other meetings were held during the programme to provide information on the progress of cooperation and validate the planned actions. Moreover, a newsletter was published each year to inform fishing professionals about the programme's progress.

BROAD COMMUNICATION

In addition to children and specific targets (pleasure boaters and fishermen), the programme's objective was also to inform a wider public of the presence of Bottlenose dolphins in the Mediterranean, the impact of human activities and the action taken by the LINDA programme. For this, different types of tools were developed for tourists, local populations and journalists.

A 26 minute documentary was made to promote the work done within the framework of the programme and the issues involved in conserving the Bottlenose dolphin. It was broadcast on SNCM and Corsica Ferries boats which cross between Corsica and the mainland during the summer, to inform tourists. The film was also broadcast on the Planète, Seasons and France 3 Corse channels which cofinanced its production. Finally, it was shown at various «nature and environment» film festivals. A 4-minute version is available for projection at trade fairs and in thoroughfares, waiting areas and for Internet diffusion.

To inform the population, twenty lecture-discussion sessions were held in winter and summer, in the presence of scientific managers or programme coordinators. All these conferences attracted more than 600 people as well as visitors to targeted events such as the Fête de la science, the Festival du vent or Cap Mer where the Life LINDA programme was also presented.

A website www.lifelinda.org also went online from 2004. It is destined to be used by local, national and European institutions, associations concerned by the problem, managers of protected marine areas and the general public. All the Life actions are described and almost all the documents produced during the Life LINDA project are accessible.

Finally, the media, as a relay target, were invited to 2 press conferences at which the programme and results were presented. Local and national journalists (environment and leisure magazines) passed on the information.

WWF

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The Life LINDA programme, spanning from 2003 to 2007 and with a view to developing fishing and yachting sustainable practices, brought together environment protection main actors, socio-economic representatives, tourists and pleasure boaters as well as local populations.

Bottlenose dolphin population monitoring on three survey sites (Saint-Florent, Porto-Galeria, Bouches de Bonifacio) contributed to improve knowledge on species ecology: 225 Bottlenose dolphins have been observed whereof 117 pictured and recognizable. The survey shows in particular that Bottlenose dolphins may move across wide-ranging spaces, without there being any particular relation between preferred habitats and fishing grounds.

Fishing activity monitoring confirms that Bottlenose dolphins attack one fishing line out of ten on average, both depending on which areas and what times of year. Moreover Bottlenose dolphin predation on fishing lines does not modify production significantly. It does however bear a significant impact on fishing line wear-out: a score of attacks entails such damage that that fishing line effectiveness drops by a third and compels its replacement. Losses over a season are estimated to amount to two sets of lines. Bench tests have shown that going over from twenty-four-hour to twelve-hour hauls, using not only larger meshes but also bottom lines constitute sustainable and financially viable alternatives.

Yachting traffic reaches at times critical levels during the summer season with more than a boat a minute in the Bouches de Bonifacio sector at mid-day. Yachting and the out of bounds whale-watching often related to it have a significant impact on Bottlenose dolphin population. Such activity development is important to follow up in order to contemplate, if need be, the appropriate regulation. Significant awareness-raising campaigns were launched within the Life LINDA framework. A specifically designed educational kit helped to stage numerous activities with school children, whether in the classroom or during outings. Thus more than 10 000 people were informed, whereof a great majority of children. During the three summers the programme lasted, eco-volunteers talked to as many as 14 000 pleasure boaters about what to do when faced with marine mammals. The making and broadcasting of a 26 minute-long film, the holding of a score of conference and the setting up of the Internet site www.lifelinda.org add to the communication of the programme.

While the Life LINDA programme may not have led to finding the conclusive stratagem to inder dolphin fishing line predation it most certainly has contributed to calm down the situation and lay down the basis for a sustainable cohabitation between men and Bottlenose dolphins.



For more information all documents related to Life LINDA can be downloaded :
www.lifelinda.org et www.wwf.fr

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