

# RAPID SURVEY ON THE USE OF POLYSTYRENE IN FLOATING FARMS IN CAT BA ARCHIPELAGO, HAI PHONG, SEPTEMBER 7-8, 2016

In a recent clean-up campaign organized by IUCN and Au Co Cruises in Ha Long, polystyrene accounts for more than 50% of the total collected trash, which blights the icon of a World Heritage Site. While almost all the floating villages in Ha Long were forced to move inland in 2013, such large amount of polystyrene were thought to be originated from nearly 500 aquaculture floating farms in Cat Ba Archipelago.

In order to further investigate this issue, within the framework of the USAID funded Ha Long-Cat Ba Alliance Initiative, a project team of 9 people conducted a quick survey on the status of using polystyrene in aquaculture floating farms in five bays of Cat Ba Archipelago including Ben Beo, Lan Ha, Cat Ba, Tra Bau and Gia Luan.

The survey team consisted of representatives from IUCN, Cat Ba Heritage Management Board, Cat Ba Bay Management Board, Cat Ba National Park, Bhaya Cruise and Backpacker Hostels.

## I. Objectives of the survey

- To have an understanding of existing materials that have been used to make buoyant frames in floating farms and find an optimal material for the floats.
- To survey the quantity of expanded polystyrene blocks being used and their impacts on the environment.

## II. Scope and Methodology

- Desk study based on reports of Cat Ba Bay Management Board and internet research on optimal materials for floating frames.
- Field visit and in-depth interviews with households representing different aquaculture models in five bays of Cat Ba Archipelago. 10 individual interviews and one group discussion had been conducted with local households. 11 men and 7 women were asked about the number of polystyrene drums they are using and their opinions about pros and cons of existing materials.
- Call interview with a local supplier of polystyrene to understand about the technology and price of polystyrene

## III. Key findings

### 1. Quantity of polystyrene drums in use

Statistics report of Cat Ba Bay Management shows that by February 2016, there are 486 floating farms with more than 8,600 cages and 463 rafts mostly located in Lan Ha, Ben Beo, Cat Ba, Gia Luan and Tra Bau Bay within the Cat Ba Archipelago.

**Table 1. Total number of floating farms in five main bays of Cat Ba**

Vịnh Bến Bèo	Vịnh Lan Hạ	Cát Bà, Gia Luận, Trà Bái
305 farms	134 farms	47 farms

Source: Cat Ba Bay Management Board

The main income of households living in those farms are from fish culture (Ben Beo and Cat Ba) and mollusk culture (Lan Ha, Gia Luan, Tra Bau). For the fish culture, local people have been using plastic drums as buoyant floats for more than 15 years and only 40% of their floats are made from styrene foam. Meanwhile, for mollusk culture models, as beams of rafts have to carry 20-30 kilogram baskets of sand and spat, styrene foam floats are preferred due to their high buoyancy. As a result, nearly 100% of floats in rafts are polystyrene and only few plastic drums are used under watching houses.

To have an exact figure of the total number of expanded polystyrene in use, it will require a large scale survey, which will consume a great of time and effort. Therefore, within the budget and time constraints, the survey team made a rough calculation based on following assumptions:

- The average size of one cage is 10m<sup>2</sup>
- The average size of one polystyrene drum is 50 x 60 x 1 m
- One cage will require at least 5 float drums
- The average size of one raft is 70 m<sup>2</sup>, which possibly needs about 28 polystyrene pieces

The estimated total number of polystyrene are shown in Table 2. It is estimated that there are about 54,582 pieces of polystyrene in use in Cat Ba.

Vinh Lan Ha is estimated to have the highest number of polystyrene as almost all mollusk farms are settling there. Ranking second is Ben Beo due to the high concentration of floating farms.

Due to the advanced features of new polystyrene drums, it is expected that the number of styrene foam floats will continue to increase in the future. It is also noted that since September 5<sup>th</sup> 2016, Cat Ba Bay Management has started to collect old, broken and low quality polystyrene floats. Therefore, the number of polystyrene could be temporarily reduced when local farms need to arrange time and resources to buy the new floats but the trend will still possibly go-up.

Table 2: Estimated total number of polystyrene floats that are in use in five bays of Cat Ba Archipelago

	No farms	No people	Cage			Chòi canh (watching houses)	No rafts	Average % polystyren out of buoyancy blocks	Average no polystyrene blocks in 1 cage	Average no squares per rafts	Average no squares under a watching house)	Estimated total no polystyrene blocks in use
			No cages	Bamboo cage)	Wooden cage							
<b>Vinh Ben Beo</b>												
Dong VungTrau nam	52	149	847		712	135		40%	5	7	4	2504
TayVungTrau nam	83	240	<b>1635</b>		1456	<b>179</b>		40%	5	7	4	4344
Cua hang Vem	35	89	841		754	87		40%	5	7	4	2204
Vung o	81	183	1353		1155	198		40%	5	7	4	3894
Cua Ben Be	54	149	1037		900	137		40%	5	7	4	2896
<b>Sub- Total Vinh Ben Beo</b>	<b>305</b>	<b>810</b>	<b>5713</b>		<b>4977</b>	<b>736</b>						<b>15842</b>
<b>Ben Gia Luan</b>	19	40	203		167	36	211	100%	5	7	4	8940
<b>Ben Tra Bau</b>	12	33	202		155	47	151	100%	5	7	4	7000
<b>Vinh Lan Ha</b>	134	254	2063	95	1502	466	102	100%	5	7	4	20875
<b>Vinh Cat Ba</b>	16	50	139		57	82		100%	5	7	4	1925
<b>Total</b>	<b>486</b>	<b>1187</b>	<b>8320</b>	<b>95</b>	<b>6858</b>	<b>1367</b>	<b>464</b>					<b>54,582</b>

Source: Survey team's self - calculation based on inputs of Cat Ba Bay Management Board

## 2. Existing materials for floats in floating farms

Since their first settlement in Cat Ba, local households have used different materials to make floats and self-updating new materials to adapt to changes in their culture methodology and the environment. Floats play a crucial role in ensuring the safety of the farm and through interviews and group discussions, it is estimated that the cost for floats accounts for one third of the total cost of the buoyant frame. Therefore, the selection of materials of floats depends on the profitability of the culture models.

That might explain the reason why floats in Ben Beo appear to be of higher quality than Vinh Lan Ha and other bays as since 2012 mollusks farms, mainly located in Vinh Lan Ha and other bays have suffered a great loss from investing in otter *Lutra riarhynchaena*, resulting in big debts and low capital to invest in high quality floats.

*“I used 3 houses as collateral to borrow money from the bank and invested 6 billion in the tu hai otter but what I got back was less than 100 million VND”* a local man told the survey team.

Two main existing materials to make floats are polystyrene with canvas and plastic drums. However, among polystyrene drums, there are different configurations with various sizes, weight, buoyancy, materials of canvas and prices varies accordingly.

### 2.1. Round Plastic drums

- Average capacity: 220 liters
- Price: 400,000-500,000 VND/ new drum and 200,000 VND/old drum
- Source of supply: from local middle-men or oil/chemicals delivery ships



*Photos of plastic drums used in Ben Beo © Pham Tuan Anh, 2016*

- Pros: long life span (more than 10 years), limited impact on environment
- Cons:
  - Relatively low buoyancy compared with polystyrene so cannot be used in mollusk culture or under big floating restaurants or houses



- Air filled barrels are easy to be flattened after a certain time of carrying heavy frames. Break easily in shallow water.
- Local households need to pump up air into the barrels at least once a year. Though it does not cost much to pump it, it consumes labor costs to do so and buoyancy might reduce after that.
- Still suffer destructions from barnacles, crabs and other small crustaceans.
- It is observed by local households that the quality of new plastic drums is not as good as in the past when the wall becomes less thicker.

Although 60% of the floats in Ben Beo are made from plastic, participants in the group discussion all confirmed that if these plastic drums are broken, they will buy the 5-8 kg polystyrene pieces to replace them. The other said that they use plastic drums just because of traditional use in the history and just the matter of habits but they are fully aware of the advantages of high quality polystyrene over plastic drums.

## 2.2. Expanded polystyrene (EPS)

The EPS drums is produced by some companies in Hai Phong city such as Tan Huy Hoang Limited Company, then sold to private workshops in Lap Le Commune, Thuy Nguyen District to wear canvas for the drums. Afterwards, the foam drums with canvas are delivered by boat to each household by few local middle-men. Local households can order the configuration of the styrofoam that they want and the companies can cut the big foams based on those requests.

The polystyrene varies by sizes, weight and price.

Types	Photos	Features
1.5-2.5 kg per piece		Price: 70,000 VND Low quality, low buoyancy, easily broken, not safe and release many small pieces of styrofoam to the environment once it is broken. Short duration (maximum 3 years). Used only by very small fraction of poor households.
3-5 kg per piece		Price: 300,000-400,000 VND for 3 kg piece and 500,000 VND for 5 kg piece including canvas costs. Middle quality, longer life span. Just need to change the canvas (every 3-5 years)


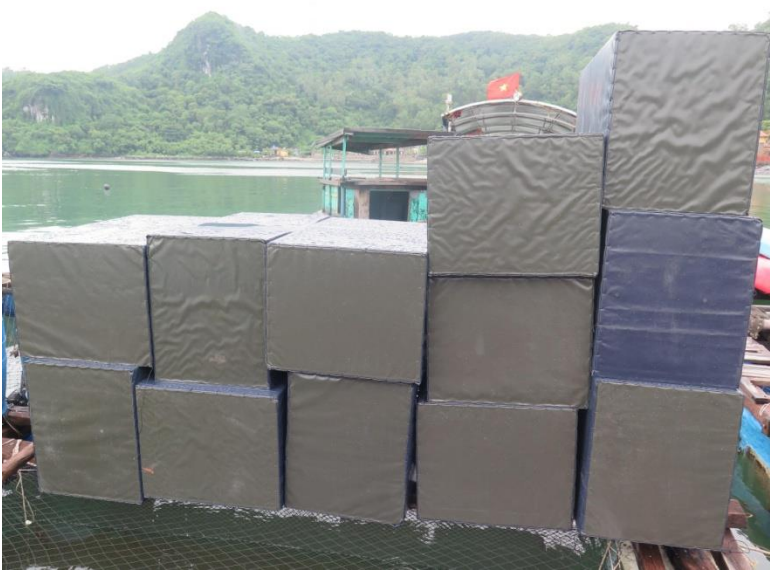



<p>8-11 kg per piece</p>		<p>Price: 750,000 -1,000,000 VND per piece including canvas costs.</p> <p>High quality, greatest buoyancy, long life span (more than 10 years) and just need to change the canvas.</p> <p>Mostly used in Ben Beo and Cat Ba due to high price</p>
<p>Polyurethane foam (PU) (perceived by local people as composite floats)</p>		<p>Price: 1,000,000-2,800,000 VND per piece.</p> <p>Harder and more stable than other polystyrene foam but easy to be broken in shallow water or when collision.</p>

*“For restaurants serving a great number of tourists, they absolutely have to use expanded polystyrene as buoyancy is much better than plastic drums”* said Vu Van Non, owner of one local restaurant.

All foam drums are covered by canvas to increase the life-span of the drums and protect against impacts of barnacles, crabs or other small crustaceans. There are different types of canvas:

Types	Photos	Features
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<p>Polyetylen Canvas</p>		<p>Cheap but short life span (2-3 years) and easy to be torn by barnacles, crabs or other small crustaceans</p>
<p>High-density polyethylene (HDPE) Canvas (called by local people as Japanese canvas)</p>		<p>Price: 100,000 VND per drum plus 50,000 VND labor costs when replacing the canvas.</p> <p>Long life span (more than 5 years) but there are still many rips as colliding with boats often happens</p>
<p>Small mesh net</p>		<p>Price: 30,000 VND per drum</p> <p>Longest life span and avoid the release of polystyrene into the water when the foam is broken</p> <p>Only in white color so can look dirty after long time in use</p>

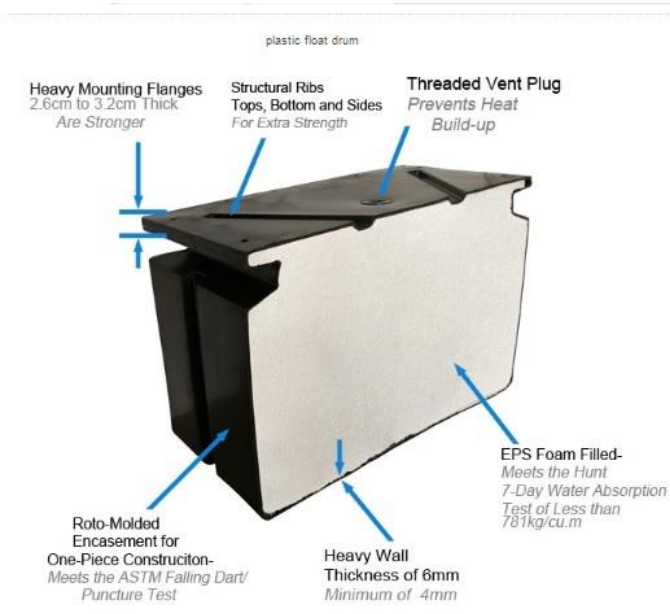
Local people often change the canvas by themselves after 3-5 years or can hire other people to do it at the cost of 50,000 VND per drum for HDPE canvas. Some families keep rotating upside down the drum to change the submerged area of the canvas in order to lengthen the duration of the canvas.

### 2.3. Environmental friendly material for floats

Given the pros and cons of existing materials and through discussion with local households, 8-11 kg polystyrene clothed with small mesh nets are supposed to be the most suitable material for floats in terms of both safety for human uses and friendliness with the environment. However, due to the high price of 8-11 kg Styrofoam drums, the less profit farms may have difficulties in investing in this high quality drum.

Another option is revealed in one interview that one farm can combine using both plastic drums and EPS drums. Plastic drums are used at the outer layers where colliding with other boats often happen while polystyrene drums are used for the inner layers to avoid effects of collision.

Some people have an idea of seeking for customized floats like putting Styrofoam inside a plastic drum or any plastic cover. If it is feasible, this kind of float will address the limitation of easily to be broken of polystyrene while helps to increase the buoyancy of barrels. After consulting with one local company, the survey team found that it is possible do so but the price will be very expensive. For example, a round plastic drum with 11 kg of polystyrene inside will cost at least 1.5 million VND excluding transportation costs and other materials to stabilize the drum. A quick internet research also shows that the technology is available over the world but the cost is very high, ranged from \$150-\$500, which is not unaffordable for such small scale businesses in Cat Ba.





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**Quick Details**

Place of Origin: Guangdong, China (Mainland)	Brand Name: GZZH	Model Number: 01
Part: floating dock	Material: HDPE	size: 1200*800*600mm,1200*800*550mm,...
Weight: 35kgs/pc	Load capacity: 450kgs/m2	Lifespan: 20years
color available: black	Quality: ISO9001:2008 certificate	Applications: Marinae,jetty
Durable: resistant to UV rays, frost, seawater, c...	Recyclable: 100% recyclable	

**Packaging & Delivery**

Packaging Use woven bags of nice quality as standard package

Details:

Delivery Detail: 10~30days after payment

Source: [https://www.alibaba.com/product-detail/foam-filled-plastic-float-drum\\_60175756593.html](https://www.alibaba.com/product-detail/foam-filled-plastic-float-drum_60175756593.html)

### 3. Impacts of polystyrene on the environment

When asked about impacts of polystyrene on the environment, almost all people know that if the foam is released to the environment, it will blight the beauty of the bays and create bad impression on tourists. However, they saw no effect on fish and other species as no case of fishes mistaking the foam with their feed has been reported. Some of them also thought polystyrene can be biodegradable along time.

Although canvas has been used to avoid the release of foams into the water, the use of cheap PE canvas and colliding with boats usually result in ripped canvas. And when it happens, local farms often have to wait to get it fixed as only few people provide this service and family members do not have enough time to do it themselves. Lack of money to replace new canvas sometimes is also an issue for poor families when families often have to wait after 6 months to 3 years to have the first turnover from their culture cages. As a consequence, during this period, many small pieces of styrofoams will be released into the water.



*Photos: ripped canvas and small pieces of foam was released into the water© Pham Tuan Anh, 2016*

Therefore, since September 5, 2016, Cat Ba Bay Management Board has started to collect old, broken and low quality polystyrene float. After 20 days of the programme, the board has collected more than 600 broken Styrofoam drums in Ben Beo and Lan Ha. This number will certainly increase until the end of the programme.

The interviews with households show that if people start using middle to high quality foams (more than 5 kg per piece) and clothed them with small mesh nets, the effects of polystyrene on the environment can be mitigated significantly. In addition, if the board can control the use of broken polystyrene through their daily trash collection at households, the situation can be improved.





*Photo: local people gradually change from PE to HPDE canvas but there are many ripped canvas© Pham Tuan Anh, 2016*

#### **IV. Conclusions and recommendations**

This rapid survey shows that local households would prefer polystyrene to plastic drums due to their high buoyancy and affordable price. The PU drums, though recommended by local authority may not work effectively as it is too hard and absorbed by water.

The use of canvas for EPS drums can increase the life span of the styrofoams and avoid the release of the foam components into the water; however, ripped canvas are very common as a result of collision with other boats or damage from barnacles and other small animals. Although local people are aware of its impacts on the beauty of the Bays and on the safety of the farms, lack of personnel and capital resources slow down the process of changing to the new canvas.

Hence, according to the team survey, controlling no ripped canvas and recommendation to use middle to high quality polystyrene (over 5 kg per piece) is a key matter in mitigating impacts of polystyrene. The local authority should provide a “carrot and stick” enforcement programme to create an incentive for the farms to do it.

Recently, the Cat Hai District People’s Committee, in collaboration with the Cat Ba Bay Management Board issued a plan to reduce the total of floating farms from 486 to 152 farms with up to 2,432 cages for fish culture and 80,000 m<sup>2</sup> of rafts for mollusk culture by 2020. Only farms meeting criteria of sustainable farms can stay and environmental friendly float is one of

many criteria for a sustainable floating farm. This criteria set is still under developed and the board is seeking for external support to complete these criteria.

It is also noted that any further support to local floating farms should be in line with this development plan of the District People's Committee.

Further scientific research, consultations with local stakeholders including local households, scientists and local authorities are necessary to find alternative materials for floats which is durable, environmental friendly and affordable.